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THE WATER QUALITY
OF
TROUT LAKE
NORTH BAY
1986

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W.J. GIBSON, Director
Northeastern Region

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OF

TROUT LAKE

NORTH BAY

1986

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Abstract - The Water Quality of Trout Lake, North Bay, 1986

In order to assist in the management of Trout Lake, North Bay, the Ministry of the Environment conducted an intensive water quality monitoring program in 1986. The results of this study, and information available from additional sampling of the lake during the period 1975-1987 were used to evaluate water quality and estimate the potential for further shoreline development.

Nutrient modelling techniques and a trophic status evaluation indicate that Trout Lake has generally excellent water quality and can assimilate considerable additional shoreline development. Caution should be used however in future development of the lake since both conversion of existing seasonal units to permanent dwellings and new developments can use up the current capacity.

Sommaire - La qualité de l'eau du lac Trout, à North Bay, 1986

En 1986, le ministère de l'Environnement mettait sur pied un programme de surveillance intensive de la qualité de l'eau du lac Trout, à North Bay, dans le but de mieux gérer celui-ci. Il s'est servi des résultats de cette étude ainsi que des données recueillies lors d'échantillonnages effectués dans le lac entre 1975 et 1987 pour évaluer la qualité de l'eau et les possibilités d'aménagement des rives.

Les techniques de modélisation des substances nutritives et l'évaluation des conditions trophiques révèlent qu'en général, la qualité de l'eau du lac Trout est excellente et que l'aménagement plus poussé des berges ne nuirait pas, à la condition que cela se fasse avec prudence. En effet, la conversion des chalets existants en résidences permanentes et la construction de nouvelles habitations pourraient absorber complètement les capacités actuelles.

INTRODUCTION

Trout Lake is a large body of water providing opportunities for a wide variety of uses. Since it supports various recreational activities and supplies drinking water for the city of North Bay, management of the lake as a high quality multipurpose water source is a major concern to residents of the area. In order to assist with proper lake management, the Ministry of the Environment conducted a water quality monitoring program in 1986.

The purpose of the program was to provide a comprehensive database for the evaluation of the water quality and associated biotic components of Trout Lake. Data are compared to information obtained in previous studies and Provincial Water Quality Objectives to determine long-term trends in water quality, to better define the trophic status and development capacity of the lake, and to direct future management decisions.

STUDY AREA DESCRIPTION

Trout Lake is located on the east border of the city of North Bay in East and West Ferris, and Widdifield Townships. The lake consists of two essentially separate bodies of water divided by a shallow constriction; Four Mile Bay (surface area 343.5 hectares, mean depth 14.3 metres) and Trout Lake proper (surface area 1583.1 hectares, mean depth 17.2 metres). This headwater lake is fed by many small streams and empties in the east to the Mattawa River system and then to the Ottawa River.

The watershed exhibits typical Precambrian Shield geology. The north shore is characterized by high, forested Precambrian hills overlain with glacial deposits while land to the south is relatively flat and composed of rock outcrops, sandy deposits and swamp. Watershed areas for Four Mile Bay and Trout Lake proper are similar, measuring 4968.7 hectares and 5824.7 hectares respectively.

Lakeshore development is predominantly permanent residential (412 units) and seasonal residential (347 units) but commercial resorts, businesses, and public beach areas are also present. As well, 186 parcels of vacant land adjoin Trout Lake. Various recreational activities such as swimmming, boating, and fishing in summer, and snowmobiling and icefishing in the winter, are common on the lake.

Trout Lake supports a diverse fish community including cold water species such as lake trout and whitefish and warm water species such as northern pike, walleye, and bass.

SURVEY PROCEDURES

Eight lake stations (1 to 8) and ten stream stations (S-1 to S-10) were sampled for various parameters during the spring, summer, and fall of 1986 (Figure 1).

Lake stations 1, 3, 4, 6, and 8 were sampled biweekly for nutrients and phytoplankton and to determine chlorophyll *a* / Secchi disc values. Also, monthly samples for the characterization group (major ions and related parameters) and metals were obtained, and dissolved oxygen / temperature profiles were measured. Lake stations 2, 5, and 7 were sampled monthly for nutrients and phytoplankton enumeration and identification. Bottom water samples were collected monthly for nutrients and major ions at stations 1, 3, 4, 6, and 8. A list of individual tests for various parameter groupings appears in Table 1. Stream stations were also sampled monthly for nutrients, metals and major ions.

Figure 1 Lake and Stream Sampling Locations, Trout Lake Survey, 1986.

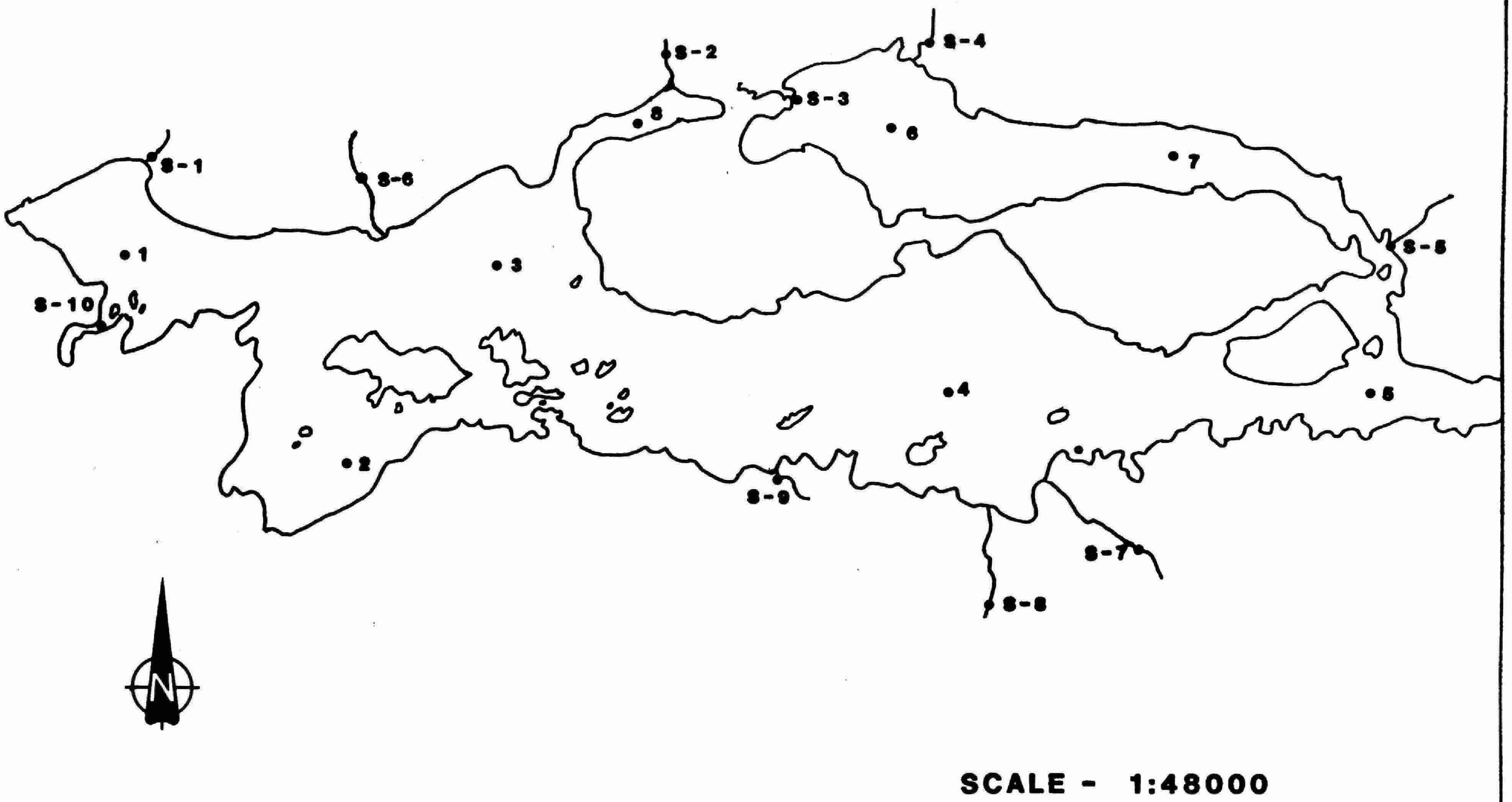


Table 1. Water Quality Parameter Groupings Sampled During Trout Lake Survey, 1986.

TEST GROUP	PARAMETER	CODE
GTCHL2	chlorophyll concentration	
NECHAR (characteristics) (major ions, etc.)	dissolved organic carbon dissolved inorganic carbon true colour sodium alkalinity hardness potassium chloride pH calcium sulphate conductivity	DOC DIC COLTR NAUR ALKT HARDT KKUR CLIDUR PH CAUR SSO4UR COND25
NENUT (nutrients)	phosphorus phosphate nitrite nitrite & nitrate total Kjeldahl nitrogen ammonia	PPUT PPO4FR NNO2FR NNOTFR NNTKUR NNHTFR
NEMET (metals)	copper cadmium nickel chromium lead aluminum zinc iron	CUUT CDUT NIUT CRUT PBUT ALUT ZNUT FEUT

All water quality data for lake stations were obtained as composite samples of the euphotic zone (depth of light penetration sufficient for photosynthetic production), except for bottom samples which were collected by use of a Van Dorn device triggered approximately 2 metres above the substrate. Water quality data for stream stations were obtained as grab samples. Samples were transported to the Ministry of the Environment laboratory in Toronto for analysis of parameters described in Table 1.

Water transparency was measured by lowering a Secchi disc (a 20 cm diameter metal disc with alternating black and white quadrants) to the depth at which it disappeared from view and then raising it until it reappeared. The average of these two values was recorded as the Secchi disc transparency; a relative measurement of the effect of suspended particulate matter and colour on light transmittance through the water.

Dissolved oxygen and temperature profiles were obtained by measuring these parameters at metre intervals using a Y.S.I. Model 54 combination meter.

Qualitative observations of aquatic macrophyte community composition, density and distribution were made monthly during the survey.

WATER QUALITY EVALUATION

Dissolved Oxygen and Temperature

Profiles and isopleths of dissolved oxygen concentrations and temperatures over the sampling season are presented in Appendix I. Isopleths are lines joining points of equal value that provide a representative pictorial view of the different lake depths during the year. Therefore, changing patterns of thermal stratification and varying zones of dissolved oxygen levels are more easily described.

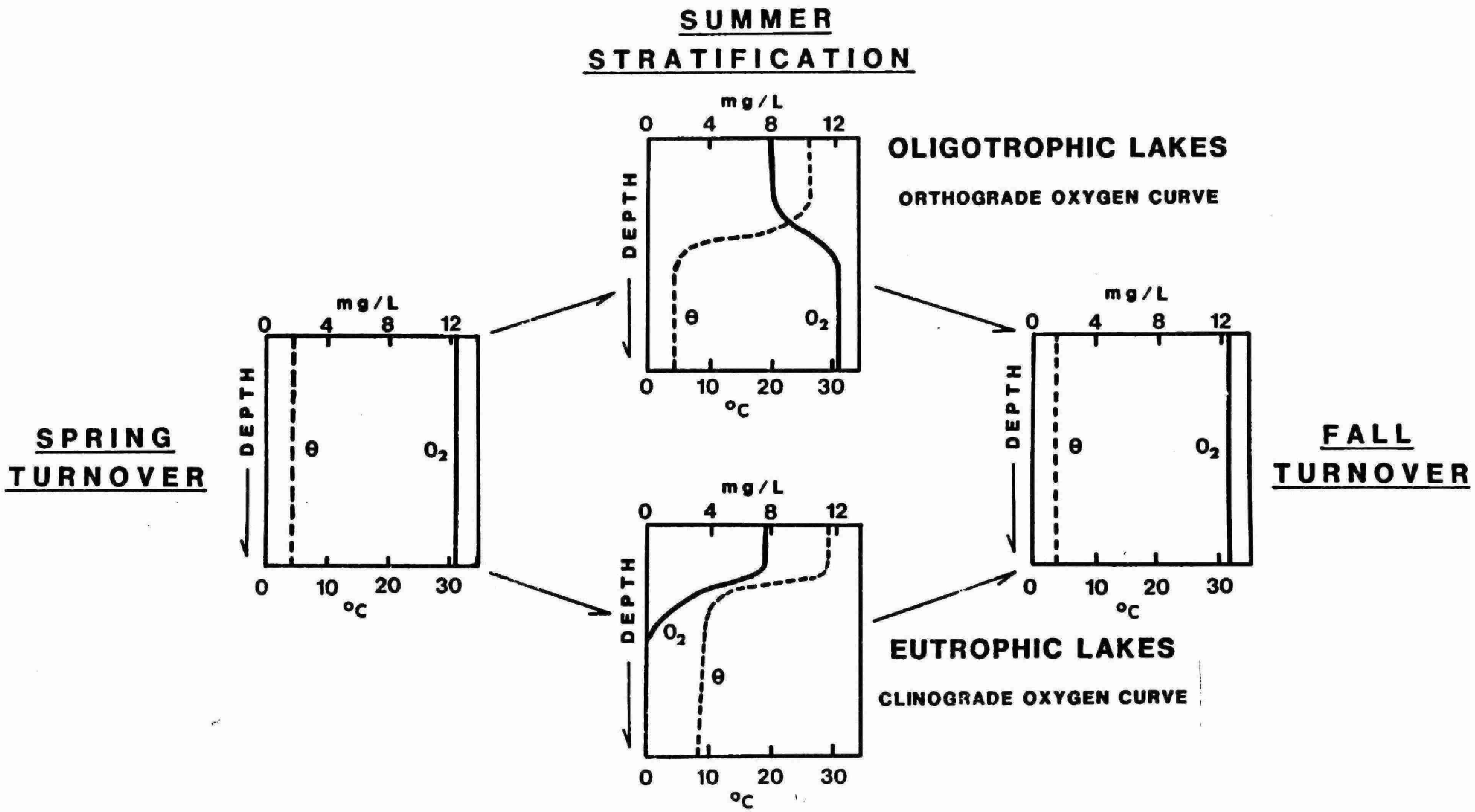
The distribution of dissolved oxygen from surface to bottom during periods of thermal stratification can be used as an indication of trophic status. A diagram showing the relationship between trophic status and vertical oxygen-temperature distributions is presented as Figure 2.

Thermal stratification of lakes involves warming of surface waters (epilimnion) through increasing summer temperatures to create a layered effect. Colder bottom waters (hypolimnion) remain distinct from the epilimnion with an area of a sharp thermal gradient (thermocline) serving as the boundary.

During the summer stratification period, the vertical oxygen distribution in oligotrophic lakes is termed orthograde which means that dissolved oxygen concentrations do not decrease with depth.

Figure 2

Dissolved Oxygen-Temperature Distributions in Northern Temperate Lakes



θ - Temperature

O_2 - Dissolved Oxygen

(Modified from Wetzel, 1975)

In eutrophic lakes where recreational activities like swimming and boating may be made less pleasant due to turbid water, algae blooms, and weed growths, vertical dissolved oxygen distributions are termed clinograde. Dissolved oxygen concentrations decline from surface to bottom due to the decomposition of organic matter settled on the bottom. In extreme situations oxygen levels below the warm surface layer may drop substantially, making the deep areas of the lake unsuitable for the support of many forms of aquatic life.

Profiles for the month of June (Appendix I) showed that thermal stratification was complete following spring turnover. Dissolved oxygen levels remained fairly uniform at all depths. These profiles were approximations of the idealized orthograde curve for an oligotrophic lake. By July, the dissolved oxygen profiles more closely resembled the "classic" orthograde curve at deep stations, however, Station 8 (One Mile Bay) began to appear more clinograde in form. This appears to be a common condition in shallower basins (to 25 m in depth) and while it may provide some evidence of increased productivity in the littoral zone, it does not indicate eutrophication of the lake. Also, this type of curve was observed in the 1977 survey and thus is not unusual for shallower areas of Trout Lake.

Profiles for August were orthograde in form at deep stations and an area of reduced dissolved oxygen concentrations was still apparent near the bottom at the shallower Station 8. Oxygen depletion at the metalimnion occured at deep sites as organic debris settling from the epilimnion was slowed as it reached the cooler, and thus denser, hypolimnion and was subjected to oxidation through bacterial degradation. These slight reductions in dissolved oxygen concentrations at the thermocline suggest only minor amounts of organic matter were present indicating that productivity was low in the euphotic zone.

By September, temperatures had cooled significantly in the epilimnion and dissolved oxygen concentrations had increased to 10 mg/L. This is evidence that water currents created by cooler weather and associated wind action had initiated a mixing process called fall turnover which was pushing the thermocline deeper by progressive erosion of the hypolimnion. October profiles exemplify the final stages of turnover as water temperatures became even colder and the thermocline was pushed deeper, further reducing the volume of the hypolimnion.

The isopleth diagram in Appendix I shows the favourable zone for lake trout. It is based on the presence of temperatures less than 10°C and dissolved oxygen concentrations greater than 6 mg/L. Shown is a "typical" Trout Lake station with Station 1 being used as a guide. The cross-hatched area is the optimal habitat for the survival, growth, and reproduction of lake trout based on the dissolved oxygen regime. The fish may venture outside this zone without suffering adverse effects, and will often do so in response to other important water quality parameters or in search of food or spawning areas, but if all other factors are acceptable, they will tend to prefer this area of optimal temperature / dissolved oxygen concentrations.

The favourable zone for Trout Lake was extremely large since portions of the lake are very deep (to 60 m) and in depths of 30 m approximately half the water column was optimal for lake trout existence. Shallower areas of the lake such as the littoral zone were of reduced desirability as lake trout habitat due to the presence of sub-optimal dissolved oxygen regimes.

Provincial Water Quality Objectives (PWQO) are designated by the Ministry of the Environment for the protection of water quality for aquatic life and recreation. Dissolved oxygen Objectives for cold water biota (lake trout) are temperature related and are stated below.

Dissolved Oxygen Concentration - Cold Water Biota

Temperature °C	Oxygen mg/L
0	8
5	7
10	6
15	6
20	5
25	5

The bottom four metres of Station 8 did not meet these Objectives during the summer months. Also, dissolved oxygen concentrations for the bottom 2 - 6 metres of Station 6 during September and October sampling periods did not meet the Objectives. However, no severe oxygen depletion of bottom waters was observed and the differences from PWQO values are considered minor.

Although these stations showed some poor dissolved oxygen conditions based on PWQO, this is not an uncommon situation at the bottom, especially in lakes of moderate depth or where the volume of the hypolimnion is low. At Station 6, a favourable zone of 10 m or more existed below the thermocline which provided sufficient optimum habitat for fish in Four Mile Bay. Lake trout tend to move out of shallow areas during the summer seeking cooler waters so Station 8 (One Mile Bay) did not likely provide preferred habitat in any case. Finally, these were localized situations only and the lake as a whole was well provided with sufficient dissolved oxygen concentrations and water temperatures for healthy fish populations.

From these observations, it appears the majority of Trout Lake was characterized by a dissolved oxygen / temperature regime suitable for the support of a cold water fishery of species such as members of the trout family. Warm water fish such as bass and pike should similarly find Trout Lake dissolved oxygen concentrations and temperatures acceptable. Also, representative dissolved oxygen profiles were orthograde in form indicating the lake is best classified as oligotrophic with excellent water quality.

Water Chemistry

Results of water chemistry analyses for Trout Lake are presented in Appendix II.

Values for pH at lake stations were slightly above neutral for surface composite samples, ranging from 7.00 to 7.57. Alkalinity values for surface samples in Four Mile Bay (7.4 - 9.0 mg/L) were less than values for Trout Lake proper (11.9 - 18.0 mg/L). Four Mile Bay (Stations 6 and 7) is considered moderately sensitive to acidic inputs or as having a fair buffering capacity and Trout Lake proper has a low acid sensitivity rating. Hardness values for surface samples in Four Mile Bay (13.0 - 15.0 mg/L) were again less than those in Trout Lake (19.0 - 21.5 mg/L) but indicating the presence of soft water in both areas. Results of analyses of bottom samples for these three parameters were all similar to corresponding values for composite samples.

Other characterization parameters (See Table 1) include major ions such as calcium, magnesium, chloride, and sulphate. Calcium (3.81 - 6.13 mg/L) and magnesium (0.94 - 1.64 mg/L) were present in moderately low concentrations in surface waters of Trout Lake while chloride (3.45 - 11.80 mg/L) was considered present in moderate levels. Sulphate concentrations from 2.34 to 3.16 mg/L measured on June 10 were very low and considered as questionable results. All other sulphate measurements ranged from 6.00 to 10.30 mg/L and are categorized as low. All these parameters had lower concentrations in Four Mile Bay than in Trout Lake proper.

Conductivity (48.8 - 91.4 umhos/cm) indicated a moderate amount of dissolved substances were present in the lake and that Four Mile Bay was again more dilute than the main body of Trout Lake. Values for potassium and sodium followed similar trends and analyses of bottom samples produced results within ranges found for surface waters.

Of the remaining characterization parameters, dissolved inorganic carbon and dissolved organic carbon ranged from 1.2 to 4.2 mg/L and from 2.7 to 4.5 mg/L respectively and are considered low. Colour values for the main body of Trout Lake (6.5 - 9.5 TCU) were lower than those in surface samples from Four Mile Bay (11.0 - 13.5 TCU) with higher levels present in bottom samples at Station 6 (13.5 - 24.0 TCU).

Values from other bottom samples were similar to surface values from corresponding stations. Although the colour measurements from surface waters were fairly low, higher levels in Four Mile Bay may reflect the presence of higher concentrations of metals such as iron, or organic matter inputs from a large watershed to a relatively small water body.

Overall, concentrations of characterization parameters from 1986 are similar to measurements obtained during the previous 1977 survey for both surface and bottom waters. However, an increase in chloride concentrations is apparent from 1977 to 1986. Levels in the main body of the lake have changed from a range of 7.1 - 8.9 mg/L to 10.30 - 11.80 mg/L and concentrations in Four Mile Bay have increased from a range of 3.0 - 3.5 mg/L to 3.45 - 5.1 mg/L from 1977 to 1986. When assessed with regard to the Drinking Water Objective of 250 mg/L, these changes appear minor, yet may indicate a small increase in chloride loading to the watershed or some accumulation from road salting activities.

Concentrations of various metals were measured in water samples from Trout Lake during the survey (Table 1). Cadmium, chromium, copper, nickel, and lead were present in concentrations at or below the detection limits of laboratory

equipment and are considered very low. Aluminum levels were low, ranging from 7 - 55 ug/L, as were zinc levels, ranging from 8 - 25 ug/L. Iron concentrations were low, ranging from trace levels to 120 ug/L. They averaged 28.6 ug/L in the main body of Trout Lake and were higher (51.5 ug/L) in Four Mile Bay (Station 6). This may partially account for the slightly higher colour values observed in Four Mile Bay.

On the whole, heavy metal concentrations in Trout Lake surface waters are considered low. Iron concentrations were measured that were slightly higher than any found in 1977, however, the majority of iron levels were within the range of the past survey. This minor variability over nearly a decade is considered normal and of little significance. On the other hand, zinc and copper levels appeared to be substantially lower in 1986 than in 1977. This may be a direct result of an intensive cleanup of metal concentrate spills at a train derailment site near an area stream. Or, this decrease may be a result of the continued flushing over the years of these historical metal inputs from inflow streams in the Trout Lake watershed. However, the apparent decrease in zinc and copper concentrations may also be attributable to a corresponding decrease in laboratory detection limits between 1977 to 1986. Thus, zinc and copper values from the two surveys are difficult to compare with confidence and no change can be clearly demonstrated. Other metal concentrations were similar between the 1977 and 1986 surveys.

Various nutrient parameters were measured in Trout Lake in 1986; phosphorus, phosphate, and the four interrelated forms of nitrogen (Table 1).

Total phosphorus concentrations over the survey period ranged from trace levels to 13 ug/L, with the majority below 10 ug/L, and are considered low. A comparison of average summer phosphorus concentrations at each station between the 1977 and 1986 surveys is presented in Table 2 . Although total phosphorus levels show some variability at each station, the overall lake averages are both 4.1 ug/L. In Table 3, data show good agreement between spring phosphorus concentrations for the main body of Trout Lake and Four Mile Bay. Average summer phosphorus concentrations are lower than spring values since available phosphorus is assimilated by algae and removed from the water column as the dead microorganisms sink to the lake bottom. Nutrients are subsequently returned to surface waters during periods of lake recirculation. Spring phosphorus values are important in nutrient modeling techniques discussed later in the report.

Phosphates ranged from trace levels to 3 ug/L and are considered of low concentration.

Table 2. Comparison of 1977 and 1986 Mean Summertime Phosphorus Concentrations, Trout Lake.

	MEAN PHOSPHORUS CONCENTRATIONS (ug/L)		
STATION	1977	1986	
1	2.2	4.1	*
3	4.3	3.7	*
4	4.3	3.4	*
6	3.7	4.9	*
8	5.0	4.0	*
2	3.3	3.2	**
5	6.3	3.8	**
7	4.0	5.8	**
AVERAGE	4.1	4.1	

NOTE: 1977 station averages are based on three measurements.
* based on 9 measurements
** based on 6 measurements

Table 3. Average Spring Phosphorus Concentrations for Trout Lake, 1975 - 1987.

	AVERAGE SPRING PHOSPHORUS CONCENTRATION (ug/L)		
YEAR	TROUT LAKE TOTAL	TROUT LAKE PROPER	4-MILE BAY
1975	5.3	5.5	5.0
1976	9.3	9.7	8.0
1980	4.3	3.8	5.5
1982	6.3	6.2	7.0
1984	5.9	5.2	7.5
1985	6.4	7.0	5.0
1986	4.7	4.8	4.5
1987	14.1	15.2	11.0
AVERAGE	7.0	7.2	6.7

Of the various forms of nitrogen, total Kjeldahl (0.180 - 0.400 mg/L) ranged from low to moderate although most concentrations were below 0.300 mg/L and are considered low. Several high values were present during the October sampling and may indicate biased results due to contamination of samples with particulate organic matter. Ammonia (trace - 0.106 mg/L) and nitrite (0.001 - 0.008 mg/L) levels ranged from low to moderate throughout the season. Nitrate concentrations varied from 0.058 - 0.340 mg/L and are considered moderate to moderately high.

Ignoring suspiciously high Kjeldahl nitrogen values in October, total nitrogen levels (total Kjeldahl plus nitrate / nitrite) ranged from 0.290 to 0.635 mg/L, varying from low to high. Most values were less than 0.500 mg/L and thus nitrogen is considered present in moderate concentrations. The average total nitrogen to total phosphorus ratio (TN:TP) was high, in the order of 100:1, since phosphorus concentrations were uniformly very low in the presence of moderate nitrogen levels. This indicates Trout Lake is a phosphorus limited system, meaning nitrogen is available in quantities above that which can be used for photosynthetic growth in the presence of limiting quantities of phosphorus. Thus, phosphorus is the critical nutrient in Trout Lake. Additions or reductions of phosphorus should result in corresponding increases or decreases in primary productivity. Presently, the low concentrations of phosphorus reflect the low productivity and excellent water quality of the lake.

For the most part, concentrations of nutrients from bottom samples did not vary greatly from levels measured in composite samples. However, slightly elevated average concentrations of phosphorus were observed in the bottom waters of Stations 6 and 8 and surface waters of Station 7 compared to other average values. These differences were minor and may be attributed to local variability in phosphorus concentrations rather than a trend of increased nutrient levels at any location. Also, nitrate concentrations at bottom stations remained constant through late summer, while surface concentrations declined as a result of uptake by aquatic plants. An increase in October coincided with initiation of fall turnover as nutrients from the upper levels of the hypolimnion were redistributed throughout the water column. No other annual trends were apparent.

The average summertime phosphorus concentration from Four Mile Bay (5.4 ug/L) was higher than that found in Trout Lake proper (3.7 ug/L). This small difference may be indicative of the effects of nutrient loading from a large watershed on the relatively smaller volume of Four Mile Bay. Other nutrients did not show apparent differences between the two bodies of water.

Quality of surface waters is also assessed based on Ministry of the Environment PWQO and Drinking Water Objectives (DWO). If various parameters are within these Objectives, the water is deemed suitable for the protection of aquatic life and for recreational use in the case of PWQO and suitable for human consumption when within DWO.

All water chemistry measurements for Trout Lake were within PWQO. Of the parameters compared to DWO, colour and organic nitrogen (total Kjeldahl minus ammonia nitrogen) were the only two found in excessive concentrations. However, these two substances are classified as parameters related to aesthetic rather than health considerations and evaluation is based on Maximum Desirable Concentrations. This is the limit at which substances may become aesthetically objectionable to an appreciable number of consumers or may interfere with good water quality control practices.

Colour may be due to the presence of organic substances or metallic ions such as iron. It may become noticeable to consumers at levels above 5 TCU. Excess organic nitrogen may be associated with organic fouling in the distribution system and may become apparent as taste or odour problems above concentrations of 0.15 mg/L. These two parameters are

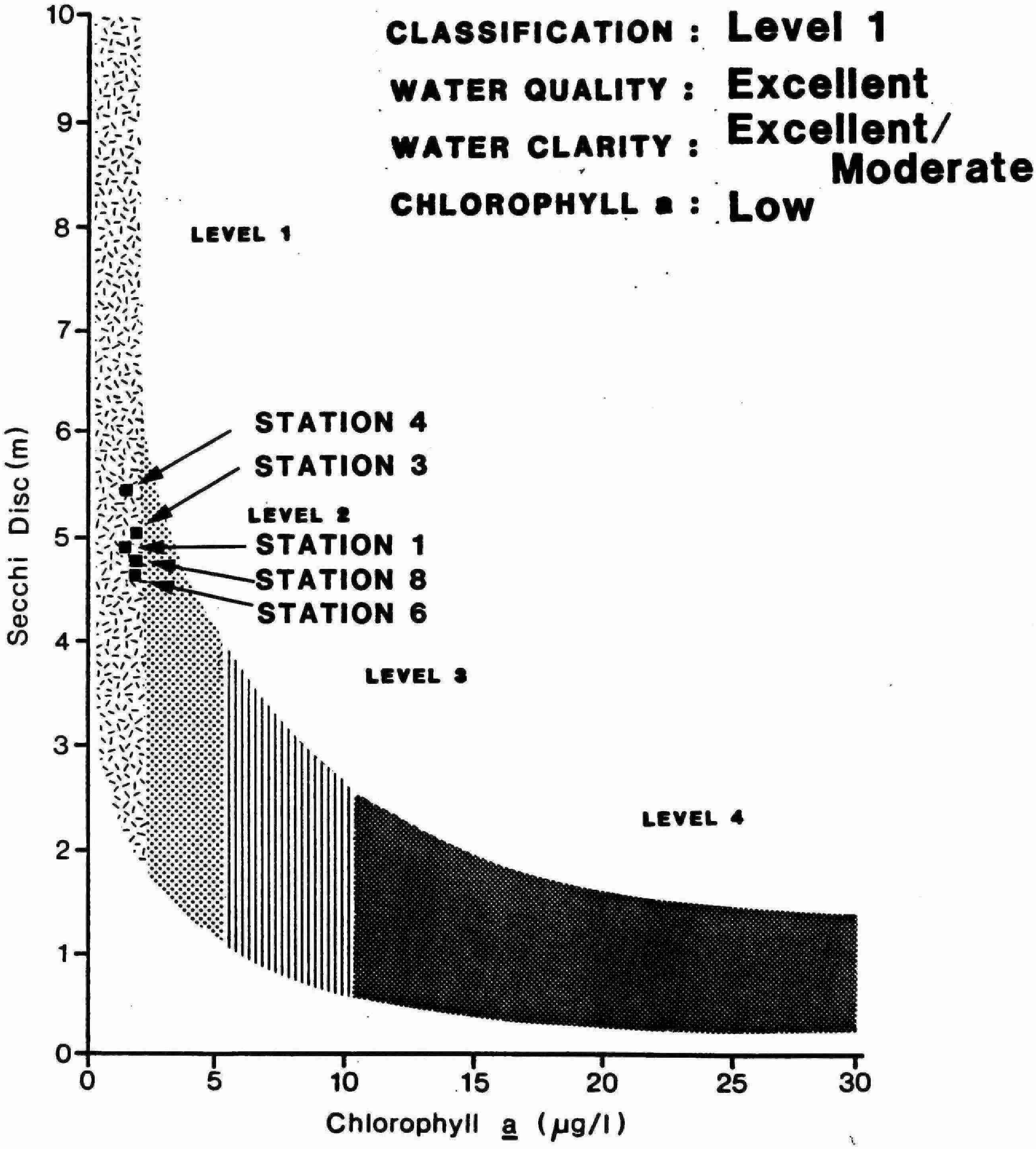
commonly measured at levels above the DWO in surface waters of this region and are considered as normal characteristics encountered in untreated lake water. These observations do not apply to any treated water supply. Overall, Trout Lake water exhibits excellent water quality characteristics when evaluated with respect to Ministry of the Environment Objectives.

Chlorophyll *a* concentration / Secchi depth relationship

Determinations of chlorophyll *a* concentrations and Secchi disc visibilities are presented in Appendix III.

Chlorophyll *a* concentrations over the sampling season ranged from 0.2 to 3.4 ug/L while Secchi depth measurements varied from 2 to 7 m. Ice-free mean values for Trout Lake were 1.8 ug/L (chlorophyll *a*) and 5.0 m (Secchi depth) and thus biological productivity is considered low and water clarity is considered excellent. These data are presented in Figure 3 which shows the positions of the various sampling stations with respect to the four levels of lake classification. This classification systems corresponds to the system based on total phosphorus concentrations discussed in the following section on nutrient modeling.

Figure 3 LAKE CLASSIFICATION BASED ON CHLOROPHYLL a / SECCHI DISC RELATIONSHIP



SECCHI DISC VISIBILITY (m)	
EXCELLENT	5 PLUS
MODERATE	2.5 TO 5
LOW	1 TO 2.5
POOR	0 TO 1

CHLOROPHYLL a CONCENTRATION (ug/l)	
LOW	0 TO 2
MODERATE	2 TO 5
HIGH	5 TO 10
EXCESSIVE	10 PLUS

Average Secchi depths for stations on the main body of Trout Lake ranged from 4.8 to 5.4 m and indicate moderate to excellent visibilities. Four Mile Bay, represented by Station 6, had moderate water clarity with a Secchi depth of 4.7 m. Chlorophyll _a_ concentrations for all stations were below 2 ug/L and thus both portions of Trout Lake are categorized as having low biological productivities. This characteristic results in an overall classification for the lake as Level 1 or as having excellent water quality.

A comparison of 1977 to 1986 chlorophyll _a_ concentrations and Secchi depths is presented in Table 4. Water clarity, measured as the Secchi depth, appears to have decreased slightly while primary productivity, measured as the chlorophyll _a_ concentration, has increased. However, due to the inherent variability of the Secchi depth measurement procedure when performed by different people under different weather conditions, this may not be a significant decrease. Similarly, the apparent slight difference in chlorophyll _a_ concentrations between years is due to a change in laboratory analysis procedures in 1985. When the data are corrected using the proper transformation, 1977 concentrations become very similar to 1986 values. Thus, chlorophyll _a_ concentrations representing biological productivity do not appear to have changed over the past decade.

Table 4. Mean Secchi Disc Measurements and Chlorophyll a Concentrations for Trout Lake, Ice-Free Period, 1977 and 1986.

	Secchi depth (m)		Chlorophyll a (ug/L)		
Station	1977	1986	1977*	1977**	1986
1	6.2	4.9	1.1	1.5	1.5
3	6.3	5.1	1.2	1.7	1.9
4	6.1	5.4	0.9	1.2	1.8
6	4.8	4.7	0.9	1.2	1.9
8	6.0	4.8	1.4	2.0	1.9
$\bar{x}$	5.9	5.0	1.1	1.5	1.8

* Raw data

** Transformed data due to change in laboratory procedure using $y = 1.52\ x - 0.14$

THEORETICAL NUTRIENT MODELING

In the Northeastern Region of the Ministry of the Environment, a phosphorus budget approach is being used as an indication of water quality and as a prediction of water quality changes likely to occur following the development of shoreline housing units. It has been found (Dillon, 1974) that the trophic status of lakes can be related to the amount of phosphorus present at spring turnover when the water is completely mixed.

General categories or levels of water quality based on the quantity of total phosphorus present in the spring have been identified:

Level 1 (Excellent)

Springtime phosphorus concentrations between 0 and 9.9 ug/L (mg/m^3). Such lakes are primarily suited for body contact recreation because of extremely clear water and a low order of biological productivity. In deep lakes, dissolved oxygen concentrations in hypolimnetic water will remain favourable for the support of cold water fish species like lake trout.

Level 2 (Good)

Springtime phosphorus concentrations between 10 and 18.5 ug/L. Lakes in this category are suitable for water-based recreation but the preservation of cold water fisheries is not guaranteed. Level 2 lakes are less clear with moderate primary biological activity.

Level 3 (Fair)

Springtime phosphorus concentrations between 18.5 and 29.9 ug/L. Level 3 lakes are characterized by reduced suitability for body contact aquatic recreation because of high concentrations of suspended algae and associated nuisances like odours and turbid water. Oxygen depletion in deep basins will be common and there is danger of winterkill of fish in shallow lakes.

Level 4 (Poor)

Springtime phosphorus concentrations above 30 ug/L. Such lakes are suitable only for warm water fisheries and there is considerable danger of winterkill of fish. Other recreational uses like swimming, boating and water skiing are extremely unpleasant.

Spring phosphorus concentrations for over the past decade are presented in Table 3 as mentioned previously. Mean values were 7.2 ug/L for the main body of Trout Lake and 6.7 ug/L for Four Mile Bay, averaging 7.0 ug/L for Trout Lake overall. Both areas of the lake are subsequently classified as Level 1 or as having excellent water quality. These values are used in development capacity modeling calculations.

The rationale for the use of a phosphorus budget approach and definition of parameter estimates used in theoretical nutrient modeling is presented in Appendix IV. Results of Dillon's Model calculations for the main body of Trout Lake and Four Mile Bay are summarized in Tables 5 and 6 respectively.

According to the model output, the development capacity of Trout Lake proper is 942 cottages or 182 dwellings (seasonal and permanent residential units respectively). Similarly, the capacity for Four Mile Bay is 322 cottages or 62 dwellings. These are the maximum numbers of additional units allowed on each area of Trout Lake to maintain spring phosphorus concentrations below 9.9 ug/L, resulting in continued excellent water quality.

TABLE 5. Theoretical Nutrient Modeling for the Main Body of Trout Lake.

NORTHEASTERN REGION TECHNICAL SUPPORT : DILLONS MODEL CALCULATIONS

DILLONS MODEL		UNITS
Lakename: TROUT		Date: 87 DEC 09
Township: FERRIS		By: MOE
ENTER ONLY IF AVAILABLE:		
Measured Spring P	7.2	mg/m3
Lake Trophic Level	1	mg/m3
LEVEL 1 (0-9.9)		
LEVEL 2 (10.0-18.5)		
LEVEL 3 (18.6-29.9)		
LEVEL 4 (30.0 +)		
Volume	272156800	m3
Surface Area	15831000	m2
Mean Depth	17.2	m
Total Unit Runoff	0.4122	m/yr (cfs/mi2 * 0.345)
Total Drainage Area	58247000	m2
Precipitation	0.8762	m/yr (in / 39.4)
Evaporation	0.595	m/yr (in / 39.4)
Oxic {1} / Anoxic {2}	1	
% Watershed Forested	70	
Bedrock % Igneous	100	
% Sedimentary	0	
# of Cottages	234	
Dwellings	339	
Campsites	0	
Vacant Lots	151	
Factors for cottages	616000	mg/yr
dwellings	3000000	mg/yr
campsites	193000	mg/yr
Supply, STP's	0	mg/yr

Continued

NORTHEASTERN REGION TECHNICAL SUPPORT : DILLONS MODEL CALCULATIONS

Export	4.4	mg/m2/yr
Total outflow Volume	28461091	m3/yr
Flushing Rate	0.1046	times/yr
Areal Water Load	1.80	m/yr
Phosphorus Retention	0.8734	-
Response Time	0.84	yr (times 3 to 5) Equilibrium
Precipitation Loading	22	mg/m2/yr
Supply: Drainage Area	256286800	mg/yr
Precipitation	348282000	mg/yr
Natural	604568800	mg/yr
Artificial	1254160000	mg/yr
Total	1858728800	mg/yr
Loading: Total	117.41	mg/m2/yr

Measured Spring P	7.2	mg/m3
Theoretical Spring P	8.7	mg/m3
Sensitivity Index	0.0	
Chlorophyll a	1.27	mg/m3

Permissible Loading	134.37	mg/m2/yr
Permissible Supply	2127270509	mg/m3
Theoretical Loading	97.73	mg/m2/yr
Theoretical Supply	1547105825	mg/m3

Num. of Added Cottages	942
or Added Dwellings	182
to maintain LEVEL #	1

Num. of Cottages	365
or Dwellings	71
required to raise P conc'n 1 mg/m3	

TABLE 6. Theoretical Nutrient Modeling for Four Mile Bay.

NORTHEASTERN REGION TECHNICAL SUPPORT : DILLONS MODEL CALCULATIONS

DILLONS MODEL		UNITS
Lakename: FOUR MILE BAY		Date: 87 DEC 09
Township: FERRIS		By: MOE
ENTER ONLY IF AVAILABLE:		
Measured Spring P	6.7	mg/m3
Lake Trophic Level	1	mg/m3
LEVEL 1 (0-9.9)		
LEVEL 2 (10.0-18.5)		
LEVEL 3 (18.6-29.9)		
LEVEL 4 (30.0 +)		
Volume	49233728	m3
Surface Area	3435000	m2
Mean Depth	14.3	m
Total Unit Runoff	0.4265	m/yr (cfs/mi2 * 0.345)
Total Drainage Area	49687000	m2
Precipitation	0.8762	m/yr (in / 39.4)
Evaporation	0.595	m/yr (in / 39.4)
Oxic {1} / Anoxic {2}	1	
% Watershed Forested	70	
Bedrock % Igneous	100	
% Sedimentary	0	
# of Cottages	113	
Dwellings	73	
Campsites	0	
Vacant Lots	35	
Factors for cottages	616000	mg/yr
dwellings	3000000	mg/yr
campsites	193000	mg/yr
Supply, STP's	0	mg/yr

Continued

NORTHEASTERN REGION TECHNICAL SUPPORT : DILLONS MODEL CALCULATIONS

Export	3.9	mg/m2/yr
Total outflow Volume	22157428	m3/yr
Flushing Rate	0.4500	times/yr
Areal Water Load	6.45	m/yr
Phosphorus Retention	0.6578	-
Response Time	0.53	yr (times 3 to 5) Equilibrium:
Precipitation Loading	22	mg/m2/yr
Supply: Drainage Area	193779300	mg/yr
Precipitation	75570000	mg/yr
Natural	269349300	mg/yr
Artificial	310168000	mg/yr
Total	579517300	mg/yr
Loading: Total	168.71	mg/m2/yr

Measured Spring P	6.7	mg/m3
Theoretical Spring P	9.4	mg/m3
Sensitivity Index	0.0	
Chlorophyll a	1.14	mg/m3

Permissible Loading	178.41	mg/m2/yr
Permissible Supply	612833410	mg/m3
Theoretical Loading	120.74	mg/m2/yr
Theoretical Supply	414745843	mg/m3

Num. of Added Cottages	322	
or Added Dwellings	62	
to maintain LEVEL #	1	

Num. of Cottages	105	
or Dwellings	20	
required to raise P conc'n 1 mg/m3		

These results indicate Trout Lake is highly insensitive to nutrient inputs and has a large capacity for new development. This conclusion is very different from the evaluation of development capacity in the 1977 report, where the lake was again considered to be highly insensitive but with relatively little nutrient input necessary to drop the water quality rating from excellent to good (Level 1 to Level 2). This is due to the use of spring phosphorus concentrations from 1976 that were uncharacteristically high for Trout Lake, resulting in underestimation of the development capacity. In this report, the use of spring phosphorus levels averaged over the past decade allows for more confident predictions of the effects of future development on water quality.

Theoretical spring phosphorus concentrations are also calculated by this version of the Dillon's Model. They are used primarily for comparison with measured phosphorus levels or incorporated into the model when measured spring phosphorus data are unavailable. In this case, theoretical values of 8.7 and 9.4 ug/L for Trout Lake proper and Four Mile Bay do not agree well with respective measured values of 7.2 and 6.7 ug/L. This may be a result of poor estimation of parameters used to calculate the theoretical spring phosphorus. Overestimation of natural phosphorus loading from precipitation and surface runoff, or overestimation of phosphorus inputs from artificial sources may be responsible for this discrepancy. Thus, the more reliable, measured sprinq phosphorus values were used in calculating the development capacity of Trout Lake.

Since the main body of Trout Lake supports a viable cold water fishery and is the source of the city water supply, a high order of water quality should be maintained. Deterioration beyond a Level 1 classification should be avoided.

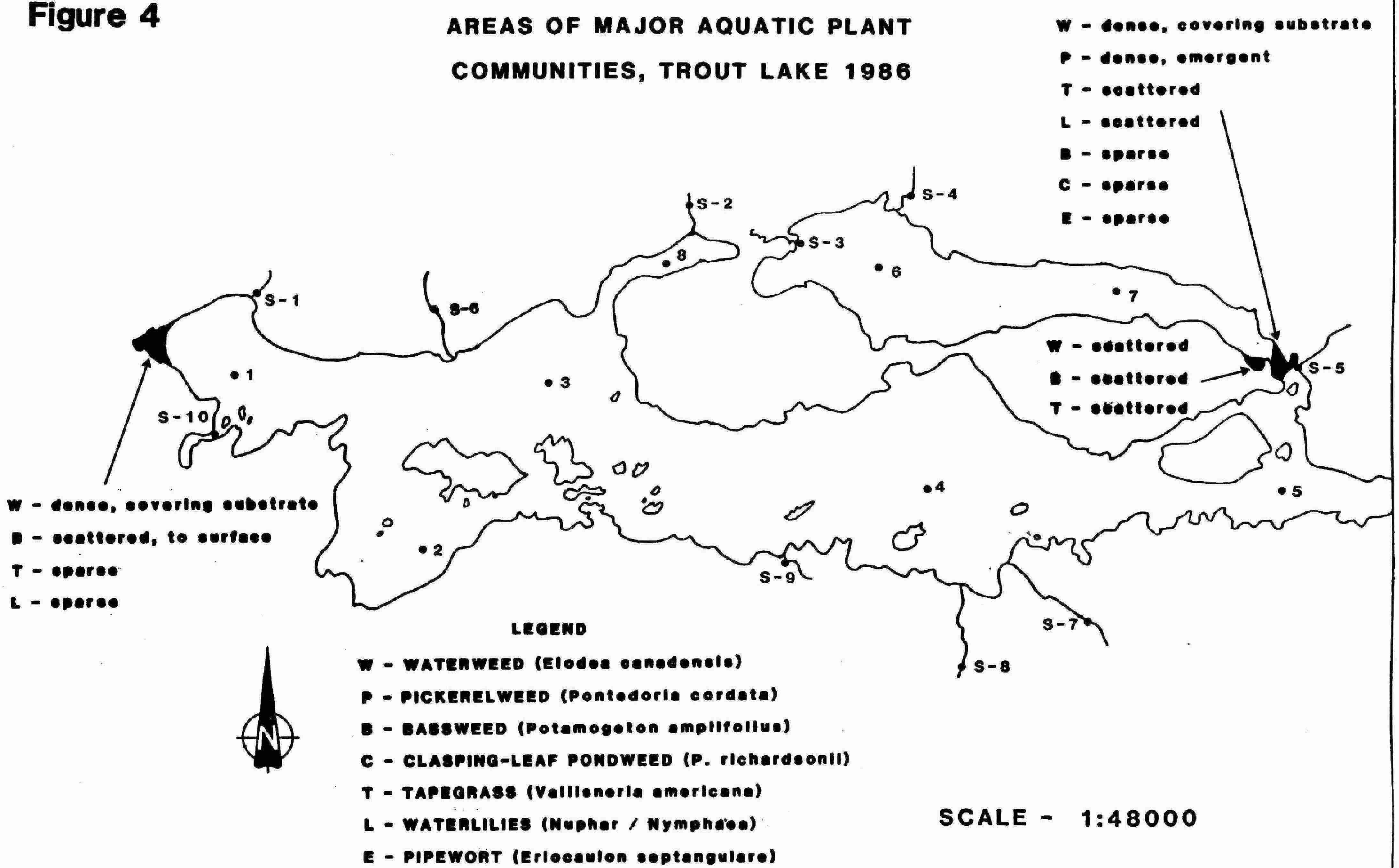
Although a relatively large development capacity exists for each of the main body of Trout Lake and Four Mile Bay, any additional shoreline development should be carefully evaluated by the local planning agencies in consultation with District staff of the Ministry of the Environment. Since the phosphorus supply for five cottages is equivalent to that of a single permanent dwelling, conversion of each existing seasonal unit to a permanent residence will eliminate the potential development of four new cottages. Based on estimates using Dillon's model, without further new development, conversion of all existing cottages to permanent dwellings will alone shift phosphorus concentrations in Trout Lake from Level 1 to Level 2. Conversely, increased servicing of lots in the future may serve to reduce nutrient inputs to the lake and may result in an increased development capacity. These and other factors should be addressed for optimum management of this valuable water resource.

AQUATIC PLANTS - PHYTOPLANKTON AND MACROPHYTES

During the 1986 water quality sampling program, field observations of aquatic macrophyte distribution and community composition were performed. Results are presented in Figure 4.

Three areas of noticeable plant growth were observed in Trout Lake. The west end of the lake near the MNR offices and the public boat launching ramp was characterized by the presence of a dense stand of *Elodea canadensis* (Canada waterweed) with a few other common North American plant varieties in occurrence in low densities (sparse). This was also the situation at the narrow constriction between Four Mile Bay and the main body of Trout Lake except *Pontederia cordata* (Pickerelweed) was also present in high densities. At the third location, the small bay west of the narrow area, only three species were identified in moderate densities (scattered). These communities are all found in very shallow areas of the lake (< 3 m) and are associated with finely partitioned, muddy sediments. The species composition of the communities appears normal and healthy, with several species occurring under similar conditions.

Figure 4 AREAS OF MAJOR AQUATIC PLANT COMMUNITIES, TROUT LAKE 1986



Although the densities and distribution of aquatic macrophytes are currently very restricted when compared to the available area for colonization, and occurrence of these species is considered normal for such a lake, a continued annual monitoring program may be beneficial. Such a program, performed once yearly in early fall at the time of peak density, would provide a comprehensive record of macrophyte growth and community changes. This would serve to better qualify concerns about increased plant densities over the years and assist in monitoring changes in trophic status in Trout Lake in the future.

While some macrophyte growth was apparent in the lake during 1986, no attached or planktonic algae were visually observed at any time during the survey and thus were not a concern with respect to aesthetic considerations.

Measurements of algae (phytoplankton) biomass and densities were obtained during the summer for Stations 1, 3, 4, 6, and 8. The 1986 average summertime biomass for Trout Lake was 0.538 mm^3/L. Values less than 1.0 mm^3/L are considered low and correspond to the low productivity of an oligotrophic lake (Schindler _et al_., 1978).

STREAM WATER CHEMISTRY

Inflow streams were sampled during June, July, August, and September of 1986 for nutrients, metals, and major ions (Table 1). Results of analyses are presented in Appendix V.

Water chemistry data for the inflowing streams were highly variable both within and among sampling locations. This situation occurs since streamflow is dependent on fluctuating rainfall events, and differences in drainage area, geology, and landuse are reflected in varying water chemistry between streams. Therefore, in this section, the inflows are briefly characterized as a group and then individual parameters are discussed with respect to PWQO.

Major ions and associated parameters were highly variable. The pH of the inflow streams ranged from 6.84 - 7.64 , while alkalinity and hardness varied from 10.6 - 53.7 mg/L and 14.0 - 63.0 mg/L respectively. Ranges of major ions such as calcium (3.56 - 16.50 mg/L), magnesium (1.00 - 5.25 mg/L), potassium (0.34 - 2.90 mg/L), sodium (1.08 - 25.30 mg/L), chloride (0.10 - 51.00 mg/L), and sulphate (2.01 - 21.85 mg/L) were quite variable between streams. However, three distinct groups of streams were apparent based on relative dissolved ion concentrations; low (S-4, S-5, S-7), moderate (S-2, S-3, S-6), and high (S-1, S-8, S-9, S-10). Conductivity values also fall into these categories and ranged from 34.7 to 231.0 mg/L. Colour, dissolved organic carbon, and dissolved inorganic carbon ranges were 9.5 - 150.0 TCU, 2.3 - 17.1 mg/L, and 2.0 - 12.0 mg/L respectively.

Only two of the parameters mentioned above, pH and alkalinity, have defined PWQO and all measured values were within given limits.

In the group of nutrient parameters analyzed, nitrogenous forms were variable among streams. Ranges for different parameters were; ammonia: 0 - 0.472 mg/L, nitrate/nitrite: 0.005 - 1.34 mg/L, nitrite: 0.0005 - 0.0560 mg/L, and total Kjeldahl nitrogen: 0.12 - 1.54 mg/L. Phosphates varied from 0 - 0.0315 mg/L while total phosphorus concentrations ranged from 0.001 - 0.123 mg/L.

Two nutrient parameters have defined Objectives; ammonia and total phosphorus. No ammonia values exceeded PWQO, however, the phosphorus PWQO for streams of 30 ug/L was consistently exceeded at Stations S-7, S-8, and S-9.

Eight metal parameters were measured at the inflowing streams. Aluminum ranged from 0.024 to 0.800 mg/L, cadmium from 0.00015 to 0.00400 mg/L, chromium from 0.0005 to 0.0030 mg/L, copper from 0 to 0.0240 mg/L, iron from 0.078 to 2.700 mg/L, nickel from 0.0010 to 0.0050 mg/L, lead from 0.0015 to 0.0060 mg/L, and zinc from 0 to 1.7 mg/L.

With respect to PWQO, stations with the most values not meeting the Objectives for metal parameters were S-2, S-3, and S-6 (Table 7). Station S-10 had only one exceedence of the PWQO for aluminum and is considered as having the best water quality characteristics of those streams monitored. All other stations had excessive concentrations of at least one metal parameter at all sampling dates.

Aluminum and iron were the two parameters most frequently measured in excess of PWQO, followed by copper, cadmium, and zinc. Objectives for chromium, nickel, and lead were met at all stations. Of the values in excess of PWQO, very high levels of cadmium and zinc were measured at Station S-2 and high levels of zinc at Station S-3. These elevated metal concentrations are the result of historical spills of concentrates at railway lines crossing areas draining to the streams. High concentrations of copper were measured at Station S-1, high aluminum levels at Stations S-6, S-8, and S-9, and consistently high iron values at Stations S-8 and S-9, with other individual high iron values found at Stations S-4, S-5, S-6, and S-7.

There was no trend toward any one metal parameter or group of metal parameters being consistently in excess of PWQO at all stations. Therefore, it appears that individual streams have unique water chemistry characteristics influenced by different catchments.

Table 7. Number of Exceedences of Heavy Metal Provincial Water Quality Objectives at Trout Lake Stream Stations, 1986.

Parameter	Stream Station									
	1	2	3	4	5	6	7	8	9	10
ALUT	0	4	4	3	3	3*	3	4	4	1
CDUT	1	4	2	1	0	0*	1	0	0	0
CRUT	0	0	0	0	0	0*	0	0	0	0
CUUT	4	4	0	0	0	3*	0	0	0	0
FEUT	0*	0*	3*	3*	3*	2**	3*	3*	3*	0*
NIUT	0	0	0	0	0	0*	0	0	0	0
PBUT	0	0	0	0	0	0*	0	0	0	0
ZNUT	0	4	4	0	0	0*	0	0	0	0

NOTE: Number of exceedences out of 4 sampling dates in June, July, August, and September.

* missing data: number of exceedences out of 3 samples

** missing data: number of exceedences out of 2 samples

Stream sampling stations for 1986 were basically the same as those monitored in the 1977 survey except that some were moved upstream to allow easier access by local roads. The stream for Station S-6 could not be found in 1986, and assuming it had dried up, the sampling effort was moved to Doran Creek, which had not been monitored in the 1977 survey. Although the 1977 survey consisted of only two sampling dates in June and July, ranges from 1977 are compared to ranges from all four dates of the 1986 survey. Also, comparison of stream water chemistry between years is generally very difficult without a comprehensive database.

Comparisons of 1977 and 1986 data for major ions and other characterization parameters at each station show some variability between years. Anions (negatively charged ions) fluctuated substantially, with chloride and sulphate increasing or decreasing at various stations, usually with a corresponding change in conductivity values. Increases in 1986 over 1977 in colour and dissolved organic carbon appear to be related to increased concentrations of nutrients such as total Kjeldahl nitrogen, nitrite, and total phosphorus. Although several stations had increases of some nutrients, Stations S-7, S-8, and S-9 had the most consistent increases in the nutrient parameter group.

Changes in detection limits due to advancing technology between 1977 and 1986 for metal parameters again makes comparison of data difficult. Zinc and copper concentrations

appear to have decreased substantially at nearly all stations by 1986, however, it remains uncertain whether it is a real decrease in metal levels or merely an effect of changes in laboratory analyses. Nickel, lead, and cadmium levels did not appear to change between years since all concentrations were at or below detection limits, however, current detection limits are 10 - 20 times lower than those in 1977 and it is unknown whether 1977 values would have been measured at these levels if the technology had been available. The exception to this case is for cadmium concentrations at Stations S-2. High values in 1977 appear to have decreased by 1986 yet changes in analytical techniques may again make this comparison invalid.

While various stations showed changes in some parameters between 1977 and 1986, the majority of water chemistry data were similar, and no trends were apparent for all stations or any related group of parameters except for noted nutrient increases at S-7, S-8, and S-9 and possibly decreased copper and zinc concentrations. These results for stream stations underline the stability of the Trout Lake system over the past decade, with only localized changes in inflow water quality apparent rather than vast differences across the watershed.

SUMMARY AND CONCLUSIONS

Water chemistry data for Trout Lake for nutrient, metal, and major ion parameter groups indicated the water quality of Trout Lake was excellent in 1986. All values for these parameters were within Provincial Water Quality Objectives (PWQO) while only colour and organic nitrogen values, two parameters related to aesthetic water quality, exceeded Drinking Water Objectives (DWO). Only very minor changes in various parameters between 1977 and 1986 were observed. As noted in the 1977 report, Four Mile Bay was substantially more dilute than the main body of Trout Lake which shows the effect of different watershed inputs.

Dissolved oxygen / temperature regimes were generally orthograde in form during the survey indicating an oligotrophic system with excellent water quality characteristics. Although Stations 6 and 8 had dissolved oxygen concentrations for the bottom few metres not meeting PWQO, the large majority of the lake's volume was favourable for the support of cold water fisheries.

Chlorophyll a concentrations and Secchi depth measurements indicated Trout Lake was characterized by excellent water clarity and low biological productivity. It was classified as a Level 1 lake.

Aquatic macrophyte growth was restricted to several small areas of Trout Lake. Three locations had fairly dense stands of a dominant plant in association with several other species. No unusual growths or exotic species were apparent.

Inflow streams had variable water quality during the survey. Phosphorus concentrations were consistently in excess of PWQO at S-7, S-8, and S-9 indicating significant nutrient loading to these streams from the surrounding watershed. Aluminum and iron were frequently measured in excess of PWQO at various stations while exceedences of copper, cadmium, and zinc were observed as well. These results may indicate a cause for concern with respect to the health of the aquatic biota in area streams, however, since all parameters measured in the lake met PWQO, there appears to be little impact on Trout Lake itself.

Since Trout Lake is a water body supporting a population of lake trout and serves as a municipal drinking water supply, limits should be imposed on the effects of added nutrients to the system as a result of increasing residential development. In order to maintain high water quality and yet allow approval of new building proposals, it is recommended that only a portion of the capacity calculated using Dillon's Model be made available for immediate development. This amount should be derived by the Municipal Planning Board in

consultation with the public, developers, the Conservation Authority, MOE, MNR, and other interested parties. Should this capacity be used up in the future and development pressure continue, further evaluation of water quality based on spring phosphorus data will result in refinement of lake management decisions.

Based on Dillon's Model, there exists an additional development capacity for Trout Lake proper of 942 seasonal or 182 permanent dwellings and additional capacity of 322 seasonal or 62 permanent dwellings for Four Mile Bay.

The possibility exists that this development capacity for Trout Lake may be allotted to new proposals, however, since the conversion of existing seasonal dwellings to permanent residences uses up the development capacity of 4 additional cottages, this potential type of "development" must also be considered in the management plan. The conversion of most existing cottages to permanent dwellings would result in a shift from a Level 1 to a Level 2 lake and an associated decline in water quality. The use of site plan controls such as setbacks, vegetation cutting controls, and erosion controls are recommended to reduce the effects of new development on the lake and maintain the assimilative capacity of the watershed. A system of accounting for new development and cottage conversions should be implemented to ensure that development capacity limits are met for the two lake areas. These recommendations will help ensure the excellent water quality of Trout Lake is maintained and made available for a wide range of uses.

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GLOSSARY

CLINOGRADE	- A dissolved oxygen curve of decreasing concentrations with depth, usually associated with a eutrophic lake.
EPILIMNION	- The upper layer of warm, circulating water.
EUPHOTIC ZONE	- The surface layer of a body of water in which light is sufficient for photosynthesis.
EUTROPHIC	- A lake characterized by high nutrient concentrations and high biological productivity.
HYPOLIMNION	- A zone of water extending from the thermocline to the bottom, with temperature fairly uniform and cold.
MACROPHYTE	- Plants visible without the aid of a microscope, usually larger, vascular plants.
MESOTROPHIC	- A lake characterized by moderate nutrient concentrations and moderate biological productivity.
OLIGOTROPHIC	- A lake characterized by low nutrient concentrations and low biological productivity.
ORTHOGRADE	- A dissolved oxygen curve of uniform or increasing concentrations with depth, usually associated with an oligotrophic lake.
THERMAL STRATIFICATION	- Partitioning of the water column due to differences in temperature.
THERMOCLINE	- The zone of maximum rate of decrease of temperature with respect to depth.

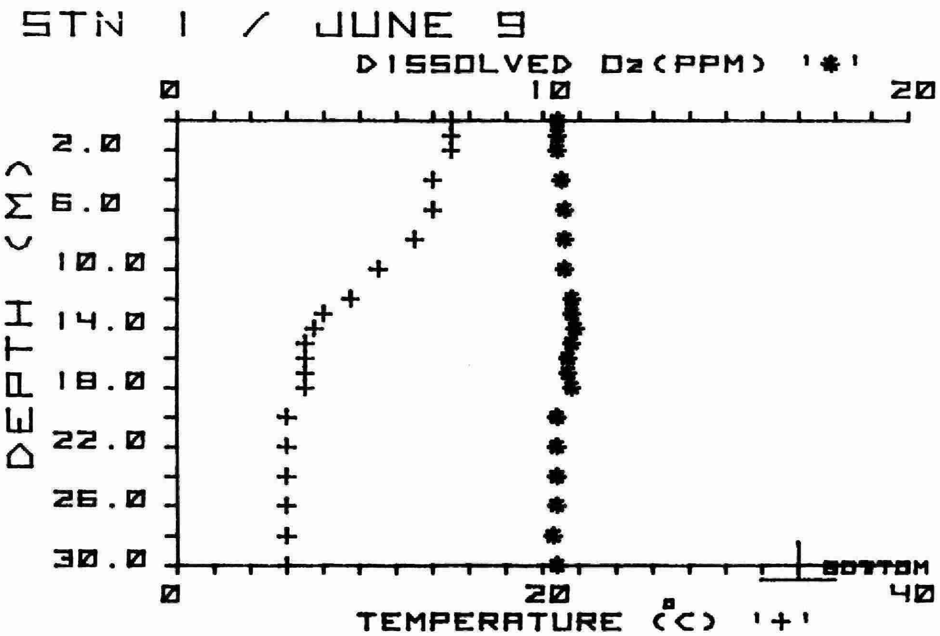
Appendix I

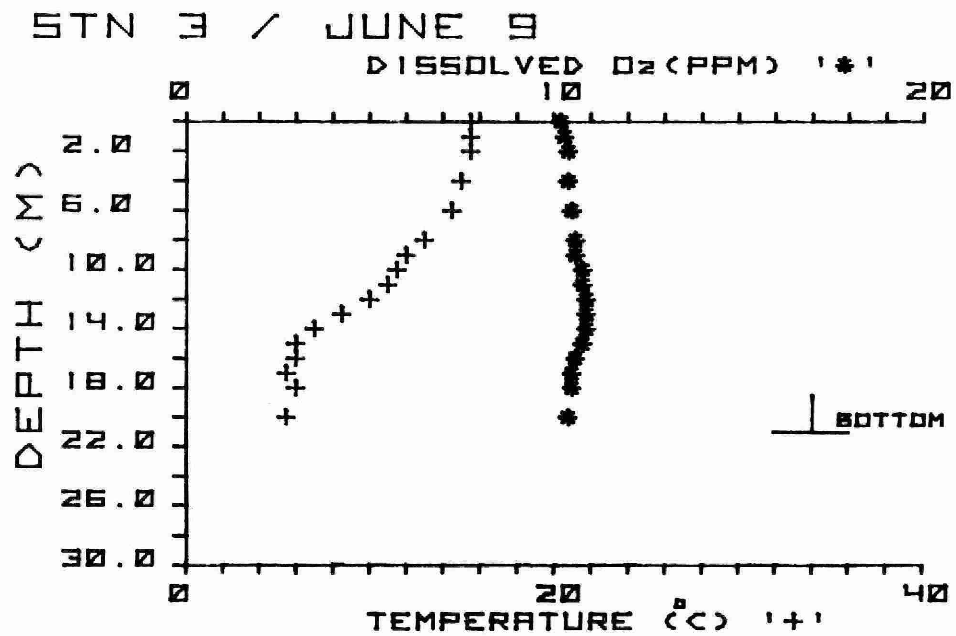
Dissolved Oxygen Concentrations / Temperature

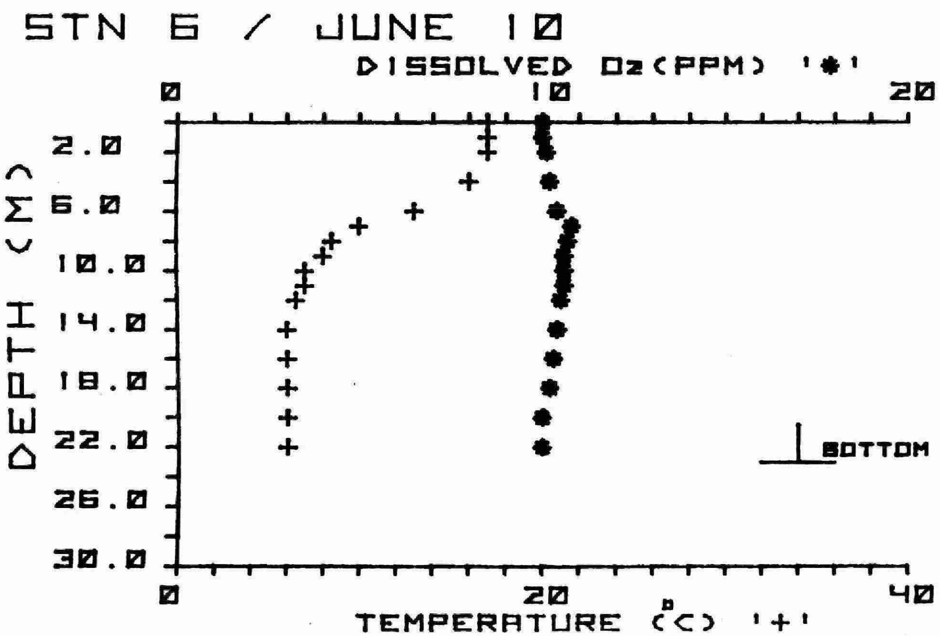
Profiles and Isopleths

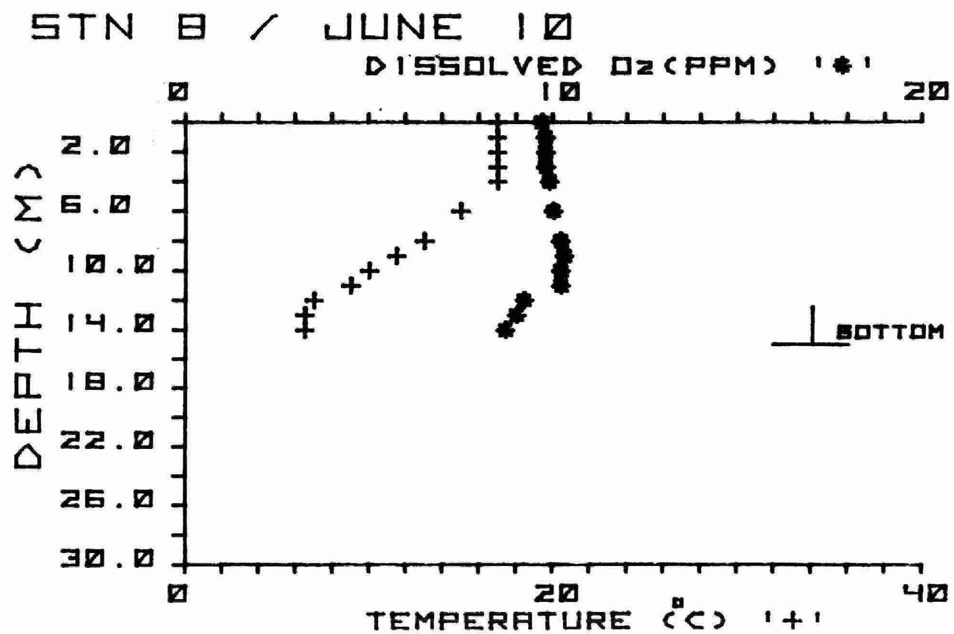
TROUT LAKE

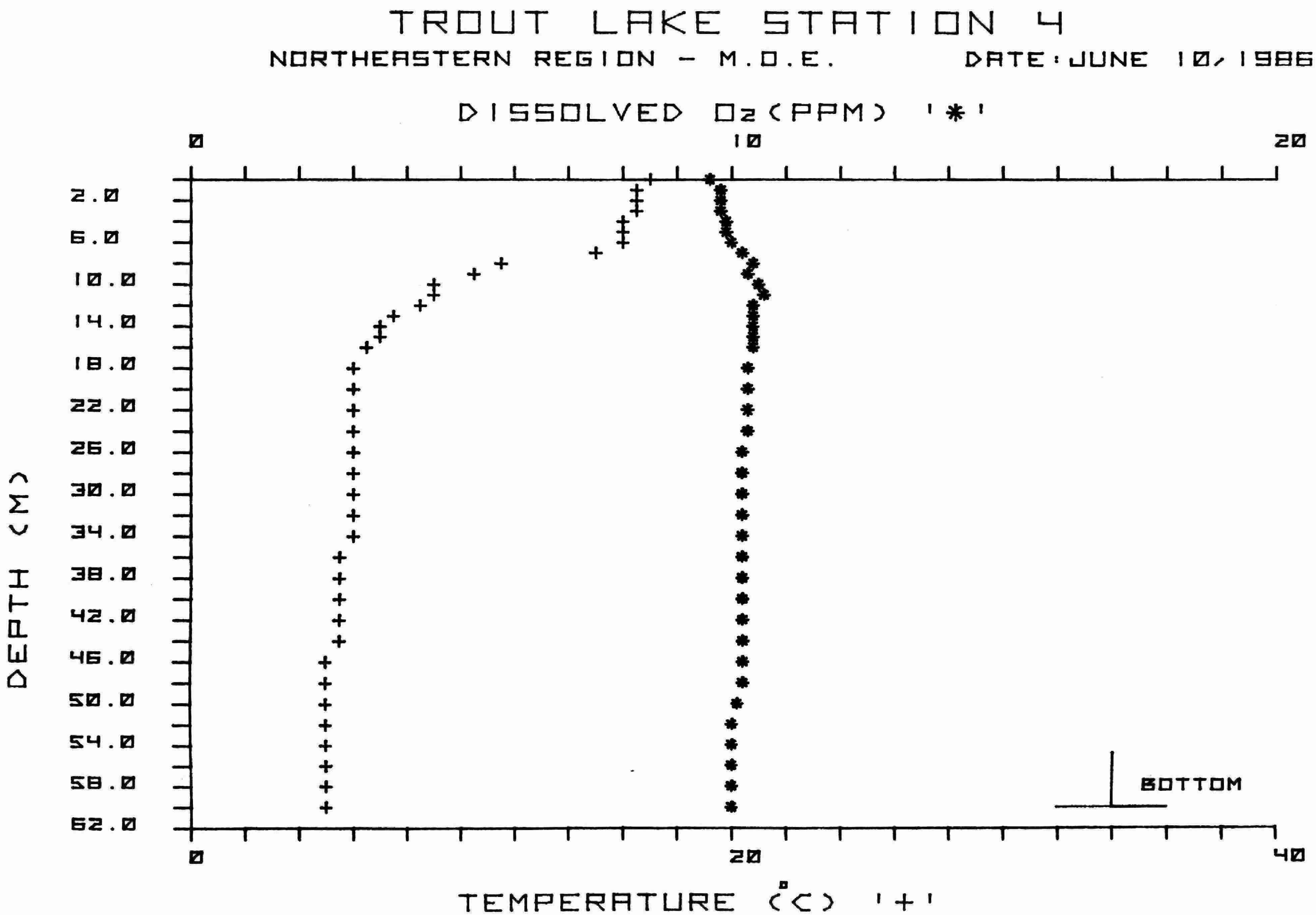
NORTHEASTERN REGION - M.O.E. 1986







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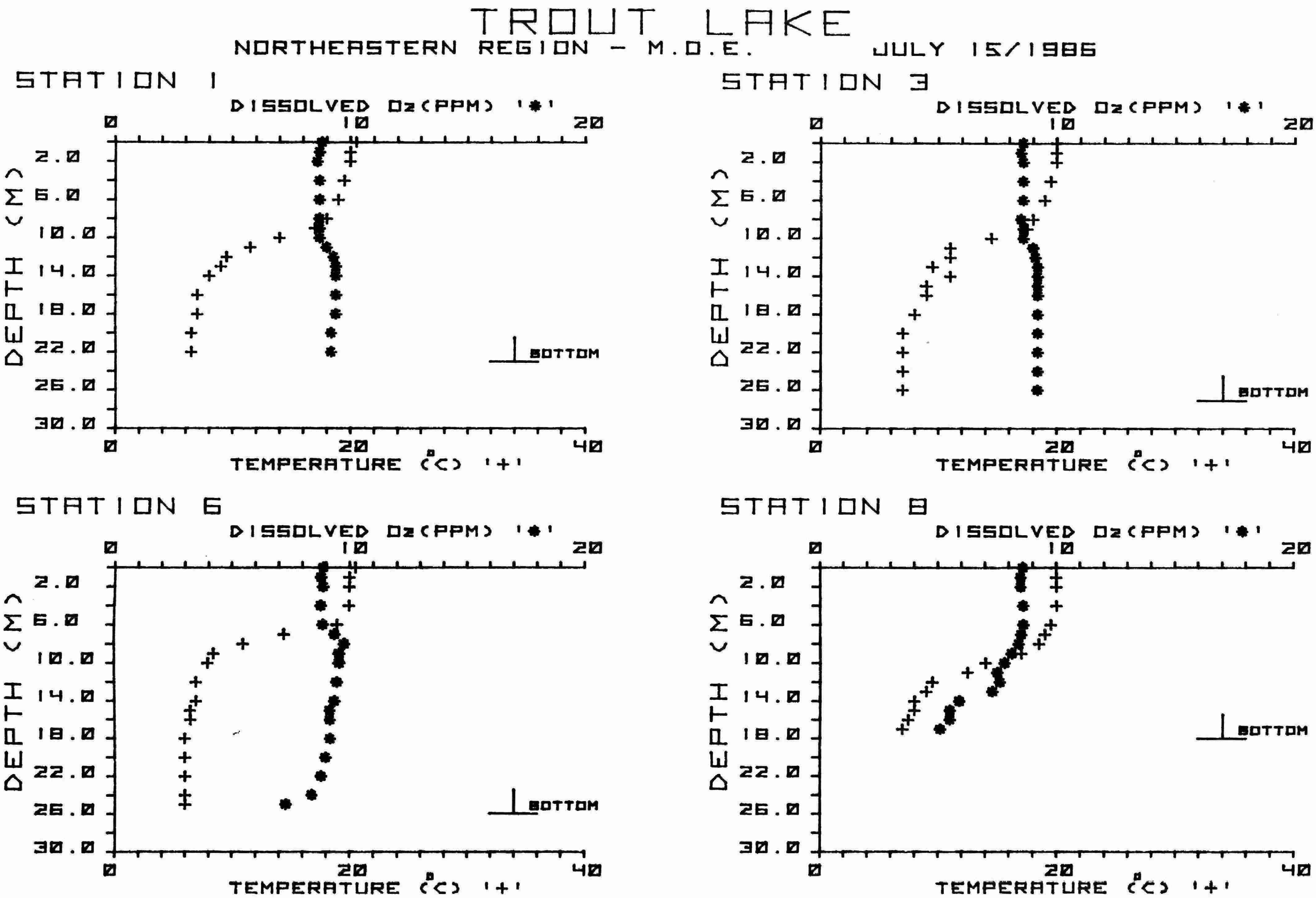
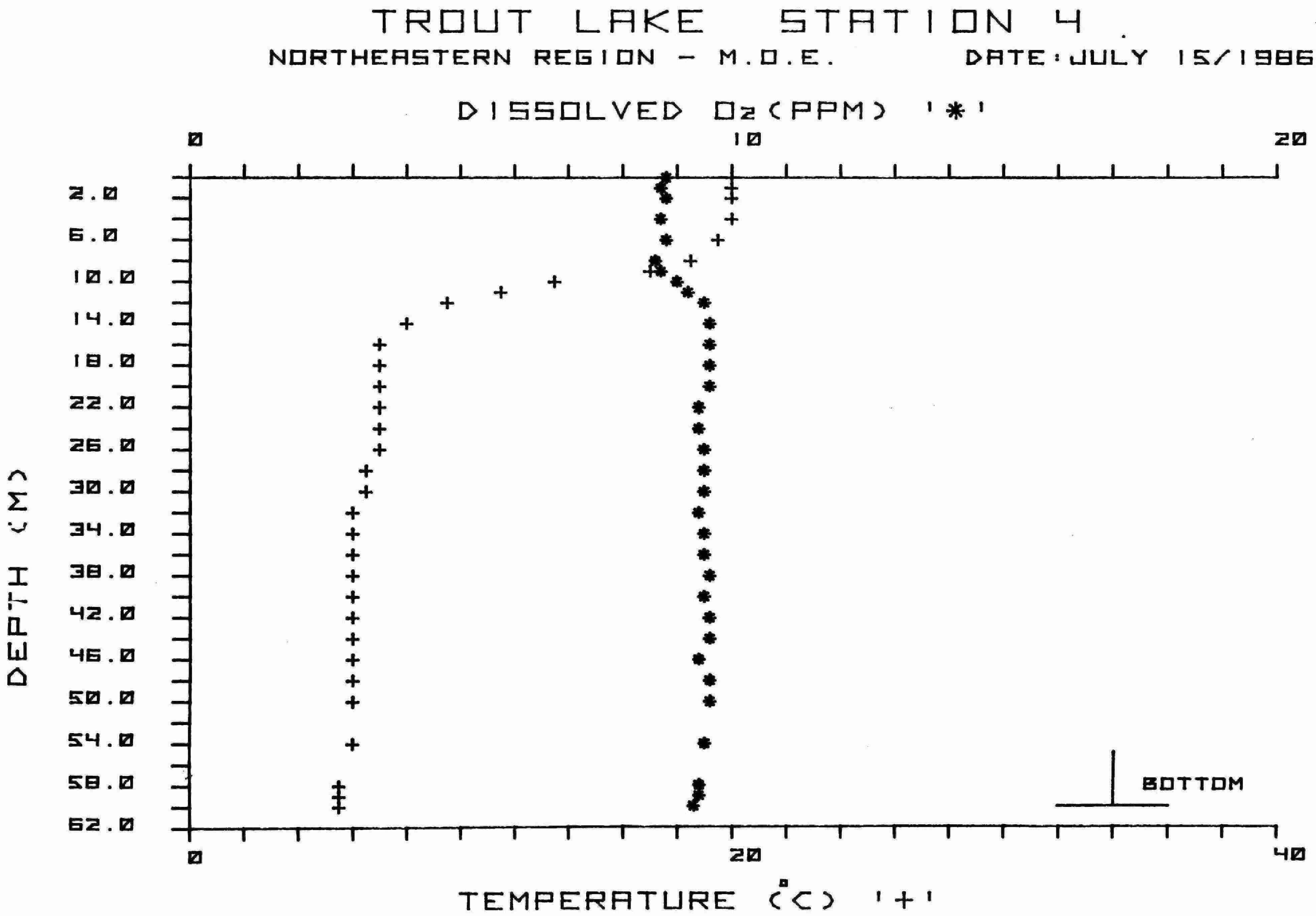
NORTHEASTERN REGION - M.O.E.
DATE:JUNE 10, 1986
DISSOLVED O2 (PPM) '*'
0
10
20
2.0
6.0
10.0
14.0
18.0
22.0
26.0
30.0
34.0
38.0
42.0
46.0
50.0
54.0
58.0
62.0
DEPTH (M)
BOTTOM
0
20
40
TEMPERATURE (°C) '+'


TROUT LAKE
NORTHEASTERN REGION - M.O.E.
JULY 15/1986
STATION 1
DISSOLVED O2 (PPM) '*'
0 10 20
DEPTH (M)
2.0 6.0 10.0 14.0 18.0 22.0 26.0 30.0
BOTTOM
0 20 40
TEMPERATURE (°C) '+'
STATION 3
DISSOLVED O2 (PPM) '*'
0 10 20
DEPTH (M)
2.0 6.0 10.0 14.0 18.0 22.0 26.0 30.0
BOTTOM
0 20 40
TEMPERATURE (°C) '+'
STATION 6
DISSOLVED O2 (PPM) '*'
0 10 20
DEPTH (M)
2.0 6.0 10.0 14.0 18.0 22.0 26.0 30.0
BOTTOM
0 20 40
TEMPERATURE (°C) '+'
STATION 8
DISSOLVED O2 (PPM) '*'
0 10 20
DEPTH (M)
2.0 6.0 10.0 14.0 18.0 22.0 26.0 30.0
BOTTOM
0 20 40
TEMPERATURE (°C) '+'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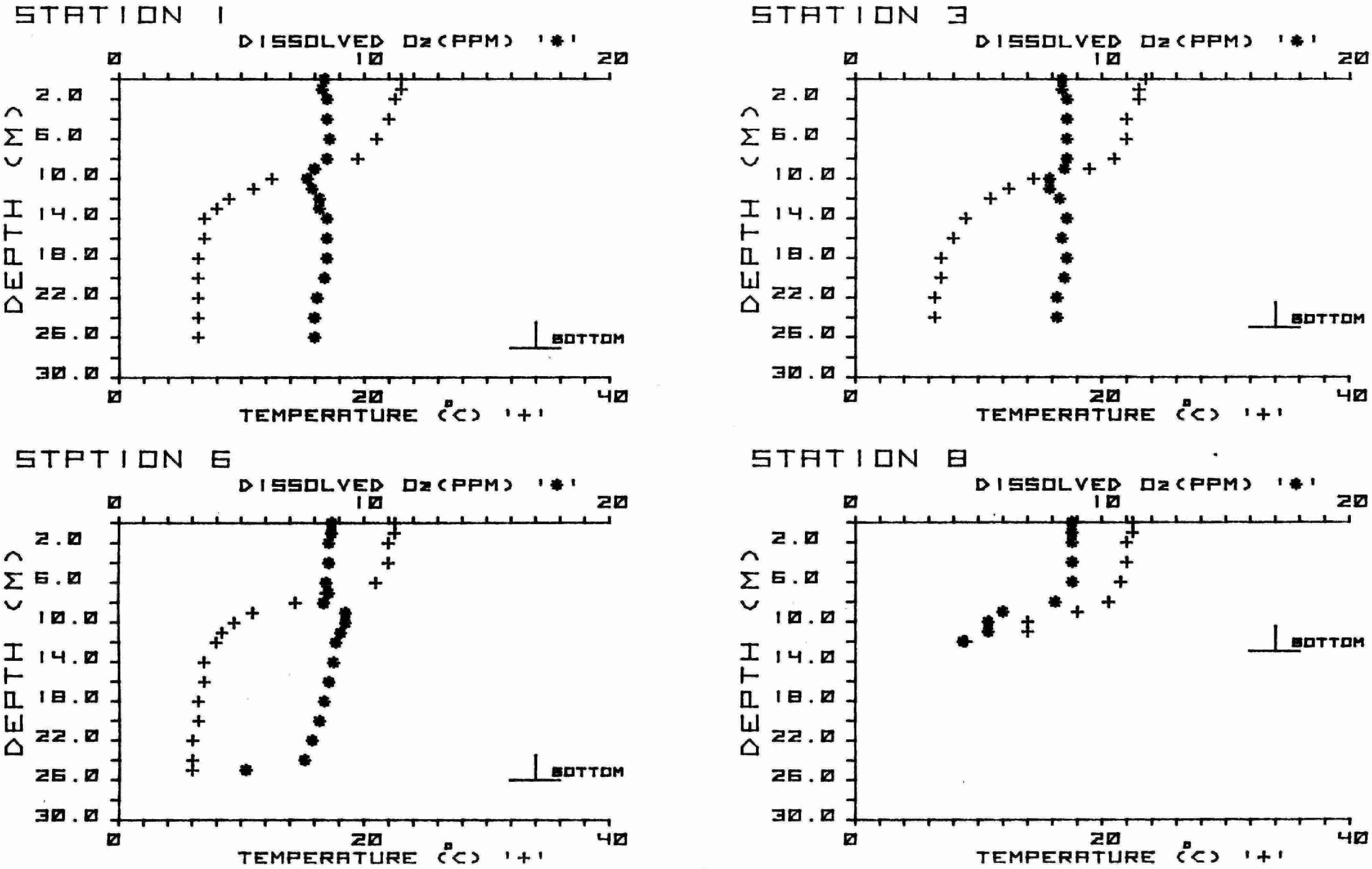
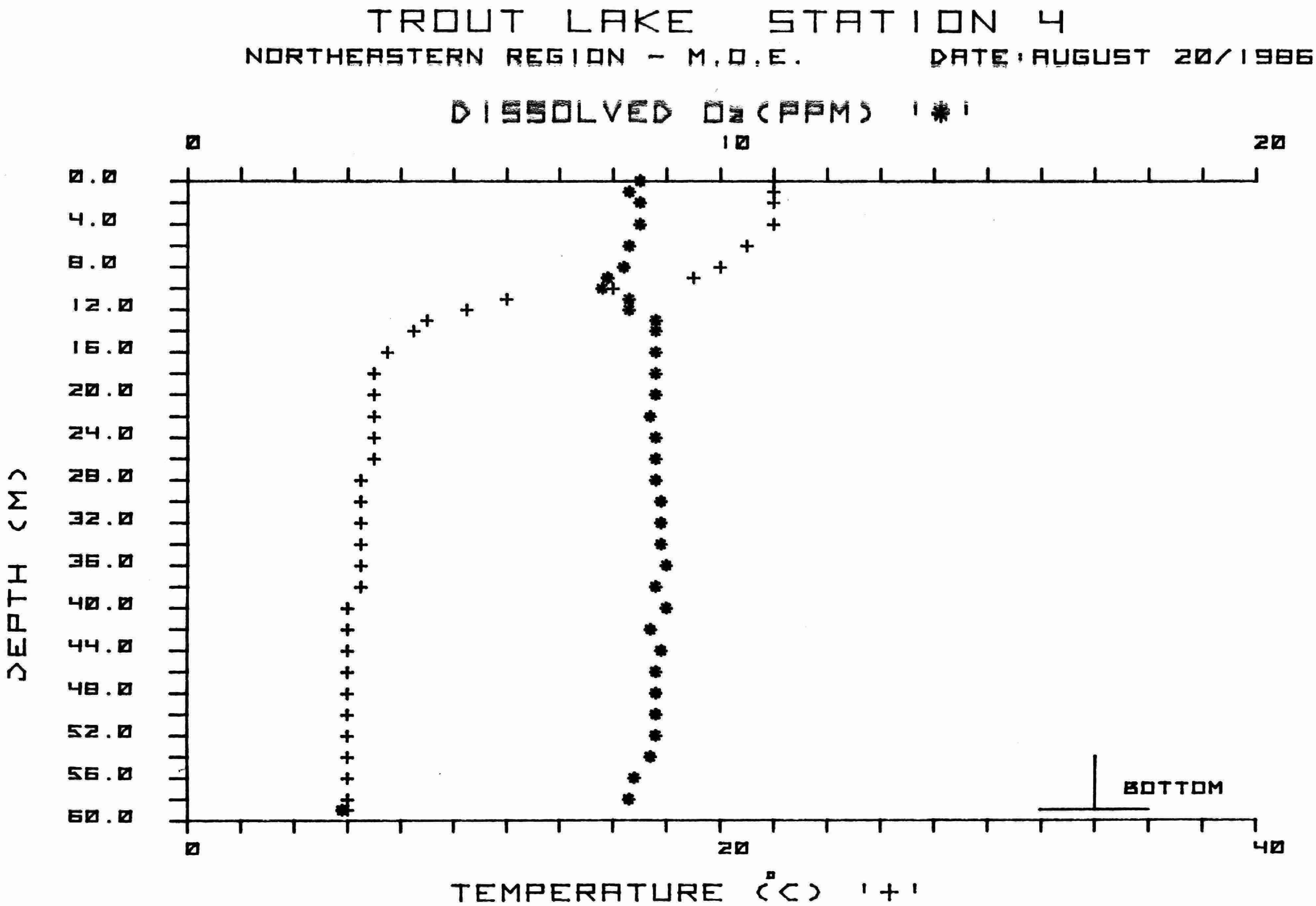
20
2.0
6.0
10.0
14.0
18.0
22.0
26.0
30.0
34.0
38.0
42.0
46.0
50.0
54.0
58.0
62.0
DEPTH (M)
BOTTOM
0
20
40
TEMPERATURE (°C) '+'

TROUT LAKE

NORTHEASTERN REGION - M.O.E.   AUGUST 20/1986

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NORTHEASTERN REGION - M.O.E.
DATE:AUGUST 20/1986
DISSOLVED O2 (PPM) '*'
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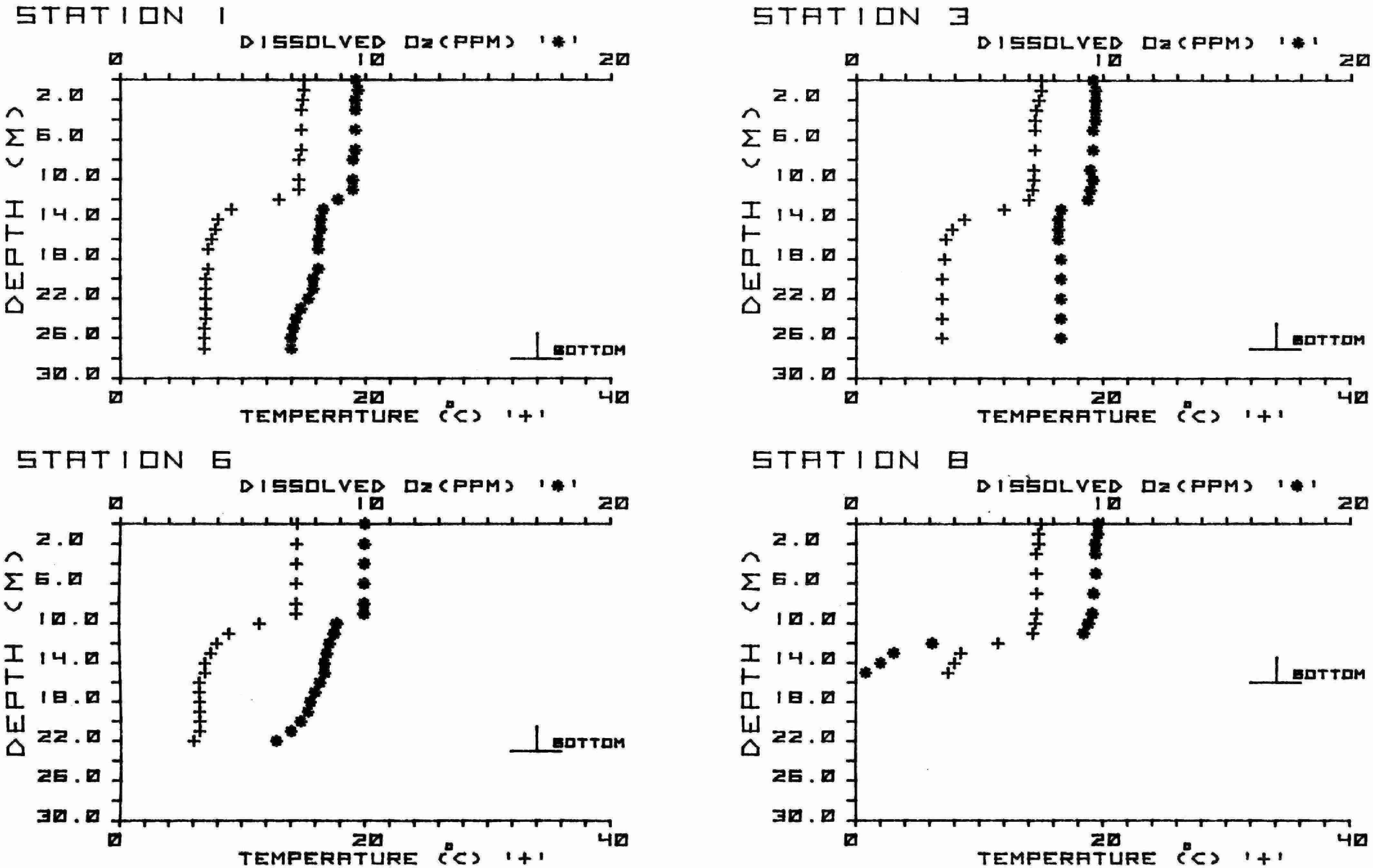
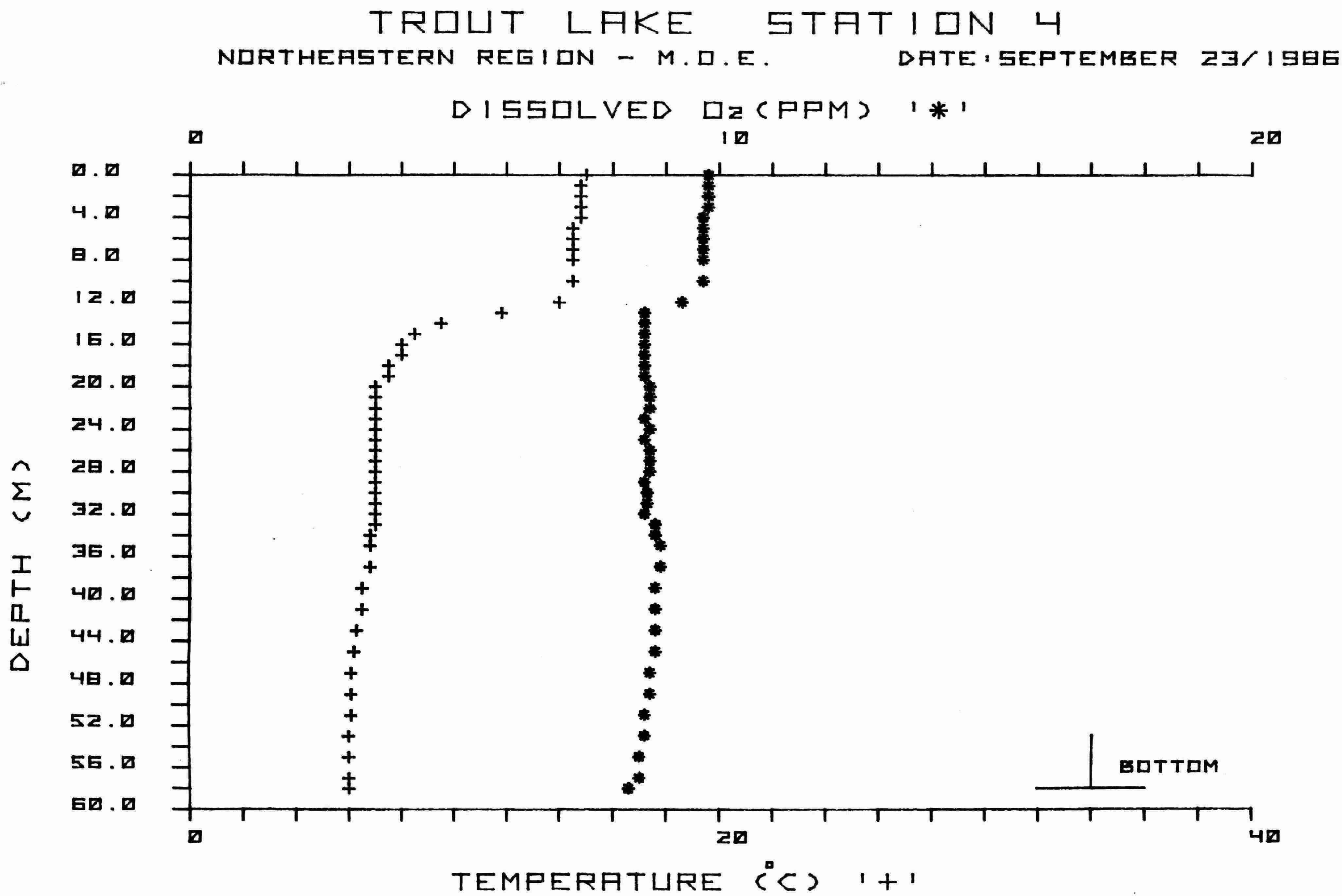
0.0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
40.0
44.0
48.0
52.0
56.0
60.0
DEPTH (M)
BOTTOM
0
20
40
TEMPERATURE (°C) '+'

TROUT LAKE

NORTHEASTERN REGION - M.O.E. SEPTEMBER 23/1986

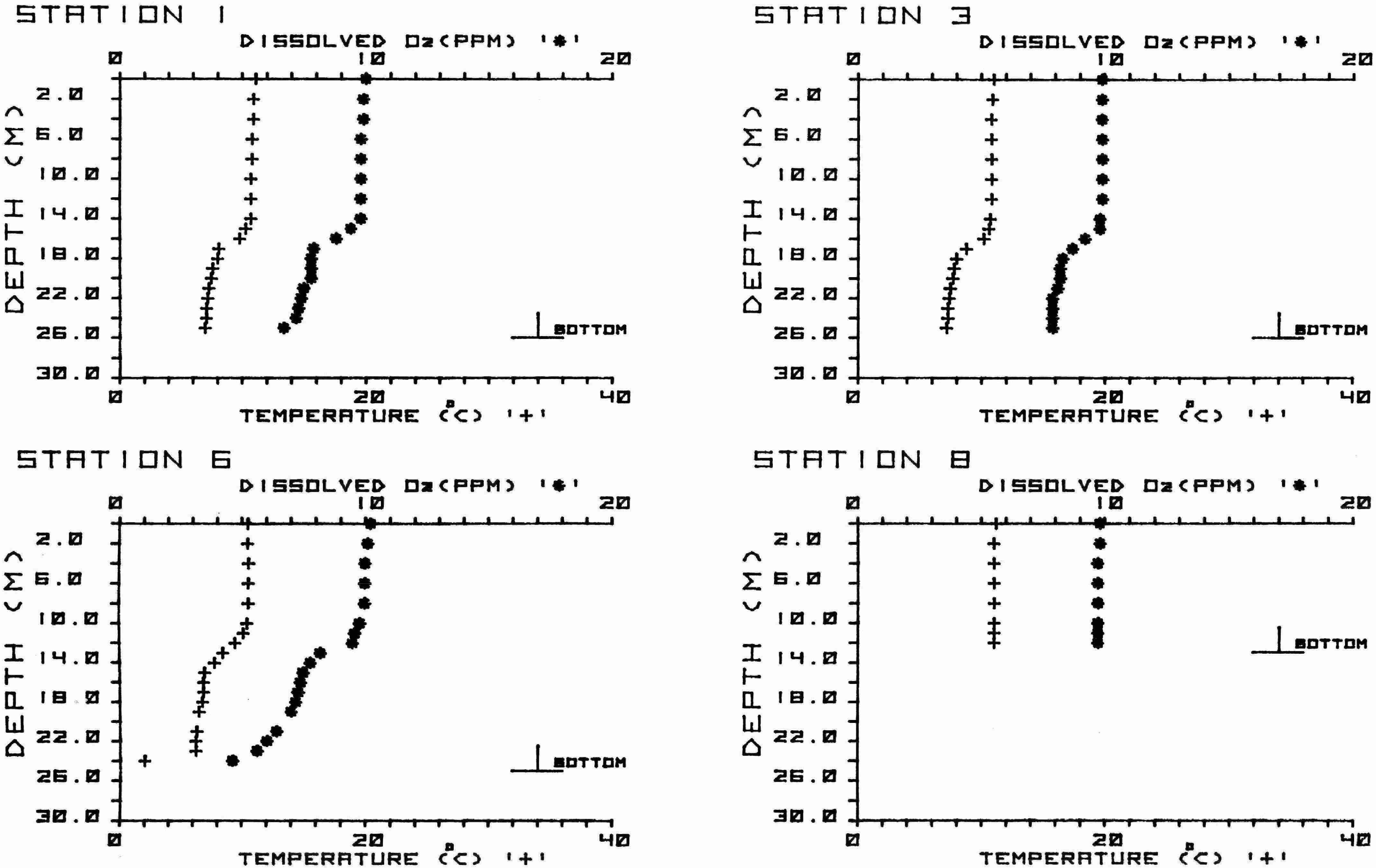




TROUT LAKE STATION 4
NORTHEASTERN REGION - M.O.E.
DATE: SEPTEMBER 23/1986
DISSOLVED O2 (PPM) '*'
0
10
20
0.0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
40.0
44.0
48.0
52.0
56.0
60.0
DEPTH (M)
BOTTOM
0
20
40
TEMPERATURE °C '+'

TROUT LAKE

NORTHEASTERN REGION - M.O.E. OCTOBER 16/1986



TROUT LAKE STATION 4

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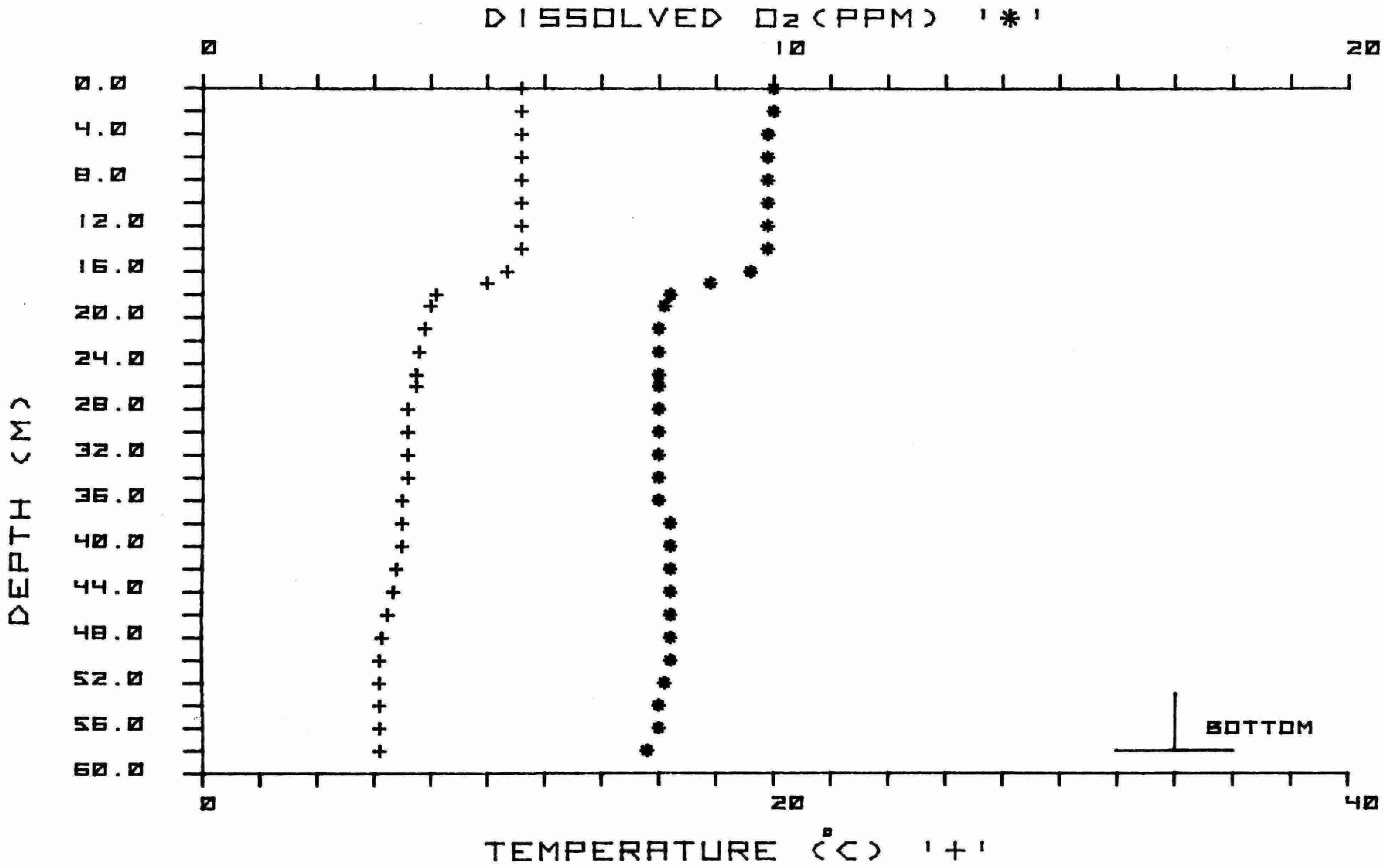
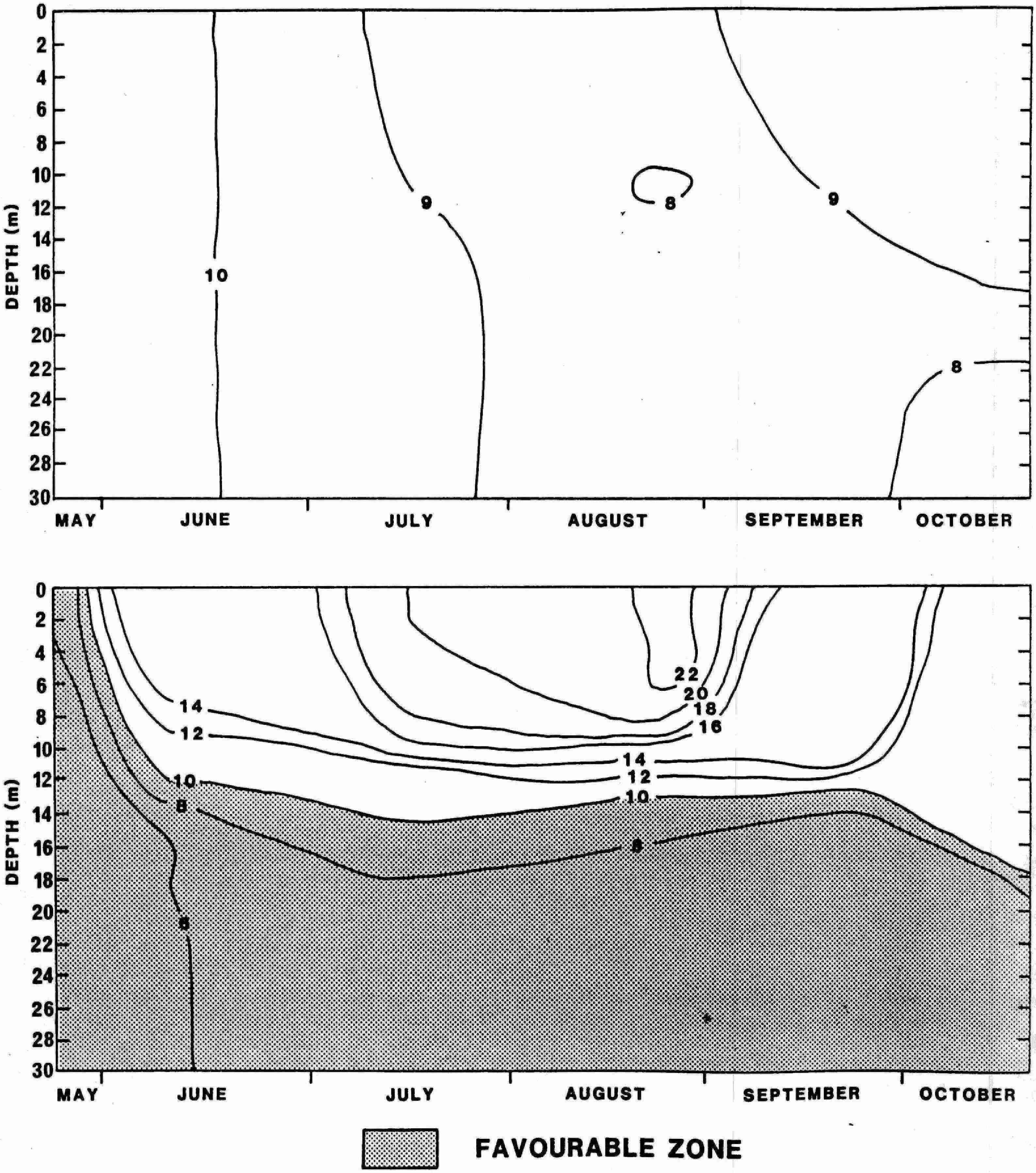


Depth - time diagram of isopleths of dissolved oxygen concentrations in mg/L (upper) and temperature in °C (lower), Trout Lake, 1986.



Appendix II

Lake Water Chemistry Data

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=1

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-1	12.1	5.61	11.10	8.5	86.7	2.6	3.3	20.5	1.19	1.62	6.47
29MAY86	0000TL01	.	.	.	.	.	.	.	.	.	.	.
09JUN86	0000JC-1	12.9	6.13	11.70	9.5	87.3	2.6	3.4	21.5	1.16	1.52	6.46
25JUN86	0000TL-1	.	.	.	.	.	.	.	.	.	.	.
08JUL86	0000TL-1	.	.	.	.	.	.	.	.	.	.	.
15JUL86	0000SH-1	12.4	5.66	11.40	8.0	86.9	2.2	3.9	20.5	1.14	1.55	6.56

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	7.24	8.61	0.040	0.2750	0.00550	0.330	0.00300	0.008	0.0240	0.00015	0.0005	0.0020
29MAY86	.	.	.	.	.	.	.	.	.	.	.	.
09JUN86	7.49	8.98	0.010	0.2300	0.00200	0.220	0.00050	0.002	0.0320	0.00015	0.0005	0.0020
25JUN86	.	.	0.002	0.2050	0.00600	0.240	0.00000	0.003	.	.	.	.
08JUL86	.	.	.	.	.	.	.	.	.	.	.	.
15JUL86	7.45	10.30	0.032	0.1950	0.00650	0.240	0.00150	0.003	0.0140	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	0.030	0.0010	0.0015	0.0170	1.0	0.6	0.3	4.1	0.57	1
29MAY86	.	.	.	.	0.6	0.3	0.2	.	.	.
09JUN86	0.020	0.0010	0.0050	0.0150	1.4	1.2	0.4	.	.	.
25JUN86	.	.	.	.	2.3	1.2	0.4	.	.	.
08JUL86	.	.	.	.	1.7	0.9	0.6	.	.	.
15JUL86	0.021	0.0010	0.0050	0.0250	1.4	1.2	0.4	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=1

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
30JUL86	0000TL-1	.	.	.	.	.	.	.	.	.	.	.
08AUG86	0000TL-1	.	.	.	.	.	.	.	.	.	.	.
20AUG86	0000JC-1	13.3	5.98	11.30	8.0	87.5	2.6	3.3	21.5	1.16	1.59	6.62
04SEP86	0000JC-1	.	.	.	.	.	.	.	.	.	.	.
23SEP86	0000JC-1	13.0	5.93	11.40	8.0	86.4	2.4	3.5	21.5	1.13	1.66	6.65
16OCT86	0000JT-1	13.3	5.71	11.70	7.0	91.4	2.4	3.5	21.0	1.20	1.59	6.94

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
30JUL86	.	.	0.022	0.1750	0.00300	0.240	0.00050	0.006	.	.	.	.
08AUG86	.	.	.	.	.	.	.	.	.	.	.	.
20AUG86	7.51	9.23	0.022	0.1400	0.00150	0.270	0.00050	0.003	0.0100	0.00015	0.0005	0.0030
04SEP86	.	.	0.022	0.1400	0.00100	0.270	0.00000	0.004	.	.	.	.
23SEP86	7.38	9.37	0.036	0.1200	0.00750	0.290	0.00000	0.005	0.0080	0.00015	0.0005	0.0020
16OCT86	7.42	7.60	0.056	0.1800	0.00300	0.890	0.00100	0.003	0.0080	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
30JUL86	.	.	.	.	2.3	1.2	0.6	4.1	0.57	1
08AUG86	.	.	.	.	2.2	2.0	0.6	.	.	.
20AUG86	0.022	0.0010	0.0015	0.0090	2.4	1.5	0.8	.	.	.
04SEP86	.	.	.	.	2.4	1.7	0.3	.	.	.
23SEP86	0.012	0.0010	0.0015	0.0100	0.2	-0.1	0.2	.	.	.
16OCT86	0.020	0.0010	0.0015	0.0100	1.5	0.7	0.4	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=2

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-2	.	.	.	.	.	.	.	.	.	.	.
09JUN86	0000JC03	12.7	5.81	11.80	9.5	87.0	2.4	3.6	21.0	1.20	1.64	6.70
15JUL86	0000SH-2	12.7	5.73	11.60	8.5	87.3	2.2	3.2	21.0	1.14	1.59	6.61
20AUG86	0000JC-2	13.2	6.03	11.49	8.5	86.6	2.6	3.8	21.5	1.18	1.61	6.74
23SEP86	0000JC-2	12.9	5.91	11.40	6.5	85.9	2.4	3.2	21.5	1.10	1.62	6.66
16OCT86	0000JT-2	13.0	5.78	11.20	8.0	87.5	2.4	3.4	21.0	1.19	1.61	6.82

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	.	.	0.024	0.2750	0.00650	0.220	0.00250	0.006	.	.	.	.
09JUN86	7.52	8.87	0.012	0.2250	0.00200	0.220	0.00000	0.000	.	.	.	.
15JUL86	7.52	9.64	0.020	0.1650	0.00700	0.240	0.00000	0.003	.	.	.	.
20AUG86	7.49	9.41	0.024	0.1400	0.00200	0.270	0.00000	0.002	.	.	.	.
23SEP86	7.42	9.56	0.048	0.0850	0.00250	0.320	0.00000	0.007	.	.	.	.
16OCT86	7.42	8.90	0.022	0.1750	0.00500	1.090	0.00100	0.001	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	.	.	.	.	.	.	.	3.2	0.39	1
09JUN86	.	.	.	.	.	.	.	.	.	.
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

LAKE=TROUT:CITY OF NORTH BAY STATION=3

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-3	12.0	5.56	10.90	8.0	84.3	2.4	3.2	20.5	1.20	1.60	6.26
29MAY86	0000TL03	.	.	.	.	.	.	.	.	.	.	.
09JUN86	0000JC04	12.6	5.76	11.20	9.0	86.3	2.4	3.1	21.0	1.15	1.60	6.43
25JUN86	0000TL-3	.	.	.	.	.	.	.	.	.	.	.
08JUL86	0000TL-3	.	.	.	.	.	.	.	.	.	.	.
15JUL86	0000SH-3	12.7	5.74	11.60	8.0	87.3	2.4	3.2	21.0	1.15	1.61	6.54

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	7.30	8.56	0.022	0.2600	0.00600	0.210	0.00200	0.004	0.0230	0.00015	0.0005	0.0010
29MAY86	.	.	.	.	.	.	.	.	.	.	.	.
09JUN86	7.54	8.98	0.014	0.2250	0.00150	0.230	0.00000	0.001	0.0300	0.00015	0.0005	0.0020
25JUN86	.	.	0.000	0.2000	0.00650	0.220	0.00000	0.004	.	.	.	.
08JUL86	.	.	.	.	.	.	.	.	.	.	.	.
15JUL86	7.53	9.55	0.026	0.1700	0.00700	0.250	0.00000	0.006	0.0170	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	0.031	0.0010	0.0015	0.0170	1.1	0.6	0.1	3.7	0.49	1
29MAY86	.	.	.	.	0.6	0.3	0.2	.	.	.
09JUN86	0.000	0.0030	0.0060	0.0150	1.4	1.1	0.5	.	.	.
25JUN86	.	.	.	.	2.6	1.4	0.4	.	.	.
08JUL86	.	.	.	.	1.2	0.7	0.5	.	.	.
15JUL86	0.025	0.0010	0.0015	0.0120	1.4	1.2	0.3	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=3

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
30JUL86	0000TL-3	.	.	.	.	.	.	.	.	.	.	.
08AUG86	0000TL-3	.	.	.	.	.	.	.	.	.	.	.
20AUG86	0000JC-3	13.3	5.85	11.20	7.5	85.8	2.6	3.3	21.0	1.18	1.58	6.73
04SEP86	0000JC-2	.	.	.	.	.	.	.	.	.	.	.
23SEP86	0000JC-3	12.9	5.90	11.50	6.5	85.8	2.4	3.4	21.5	1.17	1.64	6.78
16OCT86	0000JT-3	13.0	5.85	11.20	8.0	87.1	2.4	3.3	21.5	1.20	1.63	6.85

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
30JUL86	.	.	0.026	0.1650	0.00300	0.220	0.00000	0.004	.	.	.	.
08AUG86	.	.	.	.	.	.	.	.	.	.	.	.
20AUG86	7.50	9.25	0.030	0.1350	0.00200	0.290	0.00000	0.004	0.0090	0.00015	0.0005	0.0030
04SEP86	.	.	0.008	0.1300	0.00100	0.240	0.00000	0.002	.	.	.	.
23SEP86	7.41	9.32	0.034	0.1050	0.00350	0.310	0.00000	0.006	0.0070	0.00015	0.0005	0.0020
16OCT86	7.41	8.50	0.024	0.1800	0.00650	0.240	0.00150	0.002	0.0090	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
30JUL86	.	.	.	.	2.9	2.3	0.6	3.7	0.49	1
08AUG86	.	.	.	.	2.6	2.1	0.7	.	.	.
20AUG86	0.023	0.0010	0.0015	0.0110	3.1	2.1	0.9	.	.	.
04SEP86	.	.	.	.	3.1	2.1	0.5	.	.	.
23SEP86	0.034	0.0010	0.0015	0.0110	.	.	.	.	.	.
16OCT86	0.021	0.0010	0.0015	0.0120	1.5	0.9	0.5	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
--- LAKE=TROUT:CITY OF NORTH BAY STATION=4 ---

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-4	11.9	5.43	10.90	8.0	84.1	2.4	3.3	20.0	1.16	1.58	6.39
27MAY86	0000TL04	.	.	.	.	.	.	.	.	.	.	.
10JUN86	0000SJ-4	12.5	5.55	11.50	8.0	84.7	2.2	3.5	20.0	1.12	1.54	6.42
25JUN86	0000TL-4	.	.	.	.	.	.	.	.	.	.	.
08JUL86	0000TL-4	.	.	.	.	.	.	.	.	.	.	.
15JUL86	0000SH-4	12.7	5.66	11.40	8.0	86.5	2.2	3.3	21.0	1.15	1.62	6.51

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	7.28	8.63	0.024	0.2650	0.00550	0.240	0.00200	0.004	0.0220	0.00015	0.0005	0.0010
27MAY86	.	.	.	.	.	.	.	.	.	.	.	.
10JUN86	7.46	3.00	0.016	0.2250	0.00350	0.240	0.00050	0.006	0.0180	0.00015	0.0010	0.0030
25JUN86	.	.	0.008	0.1950	0.00800	0.240	0.00000	0.006	.	.	.	.
08JUL86	.	.	.	.	.	.	.	.	.	.	.	.
15JUL86	7.57	9.26	0.026	0.1650	0.00650	0.270	0.00000	0.002	0.0110	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	0.028	0.0010	0.0015	0.0160	1.0	0.6	0.3	3.4	0.40	1
27MAY86	.	.	.	.	0.6	0.3	0.3	.	.	.
10JUN86	0.024	0.0020	0.0015	0.0150	1.6	1.4	0.4	.	.	.
25JUN86	.	.	.	.	2.8	1.9	0.4	.	.	.
08JUL86	.	.	.	.	1.5	0.9	0.6	.	.	.
15JUL86	0.021	0.0010	0.0015	0.0120	1.3	.	0.3	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=4

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
30JUL86	0000TL-4	.	.	.	.	.	.	.	.	.	.	.
08AUG86	0000TL-4	.	.	.	.	.	.	.	.	.	.	.
20AUG86	0000JC-4	13.0	6.00	10.70	8.0	84.4	2.6	3.0	21.5	1.16	1.58	6.52
04SEP86	0000JC-3	.	.	.	.	.	.	.	.	.	.	.
23SEP86	0000JC-4	12.9	5.88	11.30	7.0	85.7	2.4	3.2	21.5	1.11	1.62	6.57
16OCT86	0000JT-4	12.9	5.78	11.30	7.5	86.4	2.4	3.3	21.0	1.15	1.62	6.59

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
30JUL86	.	.	0.022	0.1650	0.00300	0.220	0.00050	0.002	.	.	.	.
08AUG86	.	.	.	.	.	.	.	.	.	.	.	.
20AUG86	7.49	9.02	0.020	0.1350	0.00200	0.290	0.00000	0.003	0.0080	0.00015	0.0010	0.0020
04SEP86	.	.	0.018	0.1250	0.00100	0.260	0.00000	0.003	.	.	.	.
23SEP86	7.40	9.25	0.058	0.1000	0.00350	0.300	0.00000	0.004	0.0080	0.00015	0.0005	0.0020
16OCT86	7.42	8.00	0.020	0.1650	0.00300	0.690	0.00150	0.001	0.0080	0.00015	0.0010	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
30JUL86	.	.	.	.	2.5	1.5	0.6	3.4	0.40	1
08AUG86	.	.	.	.	2.5	2.0	0.5	.	.	.
20AUG86	0.120	0.0010	0.0015	0.0080	1.9	0.9	0.7	.	.	.
04SEP86	.	.	.	.	2.5	1.7	0.4	.	.	.
23SEP86	0.009	0.0010	0.0015	0.0090	2.0	1.1	0.8	.	.	.
16OCT86	0.018	0.0010	0.0015	0.0110	1.5	0.6	0.3	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY   STATION=5

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-5	.	.	.	.	.	.	.	.	.	.	.
10JUN86	0000SJ-8	18.0	5.33	10.50	8.5	52.8	2.2	3.9	19.0	1.11	1.50	5.89
15JUL86	0000SH-5	12.6	5.57	10.70	8.5	84.4	2.2	3.3	20.5	1.13	1.58	6.24
20AUG86	0000JC-5	12.7	5.93	10.60	8.5	83.0	2.6	4.5	21.5	1.15	1.58	6.45
23SEP86	0000JC-5	12.8	5.87	10.60	7.5	82.4	2.4	3.3	21.0	1.10	1.60	6.39
16OCT86	0000JT-5	12.5	5.87	10.30	8.0	81.9	2.4	3.4	21.0	1.17	1.57	6.38

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	.	.	0.032	0.2650	0.00500	0.290	0.00200	0.004	.	.	.	.
10JUN86	7.32	2.95	0.012	0.2100	0.00350	0.210	0.00000	0.004	.	.	.	.
15JUL86	7.52	9.45	0.026	0.1450	0.00600	0.270	0.00000	0.005	.	.	.	.
20AUG86	7.48	8.71	0.020	0.1200	0.00150	0.270	0.00050	0.003	.	.	.	.
23SEP86	7.40	9.22	0.036	0.0650	0.00200	0.320	0.00000	0.005	.	.	.	.
16OCT86	7.37	7.80	0.022	0.1350	0.00350	0.230	0.00150	0.002	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	.	.	.	.	.	.	.	3.8	0.51	1
10JUN86	.	.	.	.	.	.	.	.	.	.
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
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LAKE=TROUT:CITY OF NORTH BAY STATION=6

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-6	7.4	3.81	3.45	13.5	49.0	1.4	3.5	13.5	0.91	0.97	2.54
27MAY86	0000TL06	.	.	.	.	.	.	.	.	.	.	.
10JUN86	0000SJ-1	7.7	3.82	4.05	13.0	49.1	1.2	4.3	13.0	0.88	0.96	2.55
25JUN86	0000TL-6	.	.	.	.	.	.	.	.	.	.	.
08JUL86	0000TL-6	.	.	.	.	.	.	.	.	.	.	.
15JUL86	0000SH-6	8.4	3.99	3.80	11.5	51.2	1.4	3.6	14.0	0.89	1.02	2.77

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	7.00	7.50	0.022	0.2350	0.00600	0.220	0.00150	0.003	0.0550	0.00015	0.0005	0.0000
27MAY86	.	.	.	.	.	.	.	.	.	.	.	.
10JUN86	7.15	2.50	0.020	0.1800	0.00400	0.240	0.00050	0.011	0.0430	0.00015	0.0005	0.0010
25JUN86	.	.	0.012	0.1450	0.00550	0.240	0.00000	0.002	.	.	.	.
08JUL86	.	.	.	.	.	.	.	.	.	.	.	.
15JUL86	7.30	7.88	0.026	0.1500	0.00500	0.250	0.00050	0.007	0.0240	0.00015	0.0005	0.0010

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	0.095	0.0010	0.0015	0.0250	1.4	0.8	0.3	4.9	0.70	1
27MAY86	.	.	.	.	1.0	0.5	0.3	.	.	.
10JUN86	0.060	0.0010	0.0015	0.0220	1.7	1.4	0.3	.	.	.
25JUN86	.	.	.	.	2.3	1.4	0.4	.	.	.
08JUL86	.	.	.	.	1.5	1.0	0.5	.	.	.
15JUL86	0.035	0.0010	0.0015	0.0180	1.5	.	0.4	.	.	.

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LAKE=TROUT:CITY OF NORTH BAY STATION=6

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
30JUL86	0000TL-6	.	.	.	.	.	.	.	.	.	.	.
08AUG86	0000TL-6	.	.	.	.	.	.	.	.	.	.	.
20AUG86	0000JC-6	8.6	4.36	5.10	12.0	51.0	1.6	3.8	15.0	0.96	1.03	3.07
04SEP86	0000JC-4	.	.	.	.	.	.	.	.	.	.	.
23SEP86	0000JC-6	9.0	4.13	4.00	11.5	51.6	1.4	3.5	14.5	0.86	1.03	2.85
16OCT86	0000JT-6	9.0	4.34	4.05	11.5	52.4	1.4	3.5	15.0	0.98	1.06	3.08

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PFO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
30JUL86	.	.	0.018	0.1300	0.00200	0.210	0.00050	0.004	.	.	.	.
08AUG86	.	.	.	.	.	.	.	.	.	.	.	.
20AUG86	7.28	7.81	0.040	0.1000	0.00200	0.290	0.00050	0.004	0.0170	0.00015	0.0005	0.0030
04SEP86	.	.	0.034	0.0900	0.00100	0.360	0.00000	0.006	.	.	.	.
23SEP86	7.26	8.05	0.106	0.0650	0.00300	0.310	0.00000	0.006	0.0160	0.00015	0.0005	0.0000
16OCT86	7.19	6.40	0.024	0.1550	0.00550	0.200	0.00200	0.001	0.0260	0.00015	0.0005	0.0010

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
30JUL86	.	.	.	.	2.5	1.8	0.6	4.9	0.70	1
08AUG86	.	.	.	.	2.1	1.4	0.7	.	.	.
20AUG86	0.042	0.0010	0.0015	0.0140	1.9	1.1	0.8	.	.	.
04SEP86	.	.	.	.	3.1	2.5	0.7	.	.	.
23SEP86	0.025	0.0010	0.0015	0.0170	1.9	1.0	0.7	.	.	.
16OCT86	0.052	0.0010	0.0015	0.0180	1.9	0.9	0.3	.	.	.

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LAKE=TROUT:CITY OF NORTH BAY STATION=7

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-7	.	.	.	.	.	.	.	.	.	.	.
10JUN86	0000SJ-3	7.9	3.85	4.10	12.0	48.8	1.2	3.9	14.0	0.88	0.95	2.53
15JUL86	0000SH-7	8.5	3.97	3.85	12.0	51.2	1.2	3.8	14.0	0.88	0.99	2.72
20AUG86	0000JC-7	8.8	4.34	4.00	12.5	50.6	1.6	3.9	15.0	0.92	1.01	2.95
23SEP86	0000JC-7	8.9	4.15	4.00	11.0	51.3	1.6	3.4	14.5	1.03	1.03	2.91
16OCT86	0000JT-7	8.6	4.12	3.95	11.5	50.9	1.2	3.5	14.5	0.94	1.04	2.91

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	.	.	0.022	0.2400	0.00600	0.220	0.00150	0.006	.	.	.	.
10JUN86	7.14	2.34	0.016	0.1800	0.00300	0.250	0.00050	0.008	.	.	.	.
15JUL86	7.32	7.84	0.026	0.1400	0.00550	0.270	0.00000	0.006	.	.	.	.
20AUG86	7.28	7.88	0.070	0.1000	0.00250	0.340	0.00050	0.006	.	.	.	.
23SEP86	7.26	8.13	0.018	0.0600	0.00250	0.230	0.00050	0.005	.	.	.	.
16OCT86	7.18	7.10	0.028	0.1400	0.00550	0.240	0.00200	0.004	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	.	.	.	.	.	.	.	5.8	0.93	1
10JUN86	.	.	.	.	.	.	.	.	.	.
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=8

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
13MAY86	0000JC-8	.	.	.	.	.	.	.	.	.	.	.
29MAY86	0000TL08	.	.	.	.	.	.	.	.	.	.	.
10JUN86	0000SJ-6	12.8	5.60	11.80	7.5	86.4	2.2	3.6	21.0	1.15	1.59	6.46
25JUN86	0000TL-8	.	.	.	.	.	.	.	.	.	.	.
08JUL86	0000TL-8	.	.	.	.	.	.	.	.	.	.	.
15JUL86	0000SH-8	12.9	5.72	11.30	8.5	87.0	2.2	3.3	21.0	1.14	1.61	6.59

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
13MAY86	.	.	0.016	0.2550	0.00550	0.210	0.00100	0.003	.	.	.	.
29MAY86	.	.	.	.	.	.	.	.	.	.	.	.
10JUN86	7.11	3.09	0.010	0.2200	0.00300	0.250	0.00050	0.007	0.0220	0.00015	0.0005	0.0020
25JUN86	.	.	0.014	0.2000	0.00600	0.260	0.00000	0.005	.	.	.	.
08JUL86	.	.	.	.	.	.	.	.	.	.	.	.
15JUL86	7.54	9.74	0.024	0.1750	0.00700	0.240	0.00000	0.007	0.0160	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
13MAY86	.	.	.	.	.	.	.	4.0	0.54	1
29MAY86	.	.	.	.	0.7	0.4	0.2	.	.	.
10JUN86	0.027	0.0010	0.0015	0.0210	1.4	1.1	0.3	.	.	.
25JUN86	.	.	.	.	2.4	1.5	0.4	.	.	.
08JUL86	.	.	.	.	1.7	0.9	0.5	.	.	.
15JUL86	0.023	0.0010	0.0015	0.0210	1.3	.	0.2	.	.	.

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LAKE=TROUT:CITY OF NORTH BAY STATION=8

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
30JUL86	0000TL-8	.	.	.	.	.	.	.	.	.	.	.
08AUG86	0000TL-8	.	.	.	.	.	.	.	.	.	.	.
20AUG86	0000JC-8	13.1	6.09	11.10	8.0	85.1	2.6	3.3	22.0	1.17	1.61	6.67
04SEP86	0000JC-5	.	.	.	.	.	.	.	.	.	.	.
23SEP86	0000JC-8	13.4	5.99	11.60	7.0	86.8	2.6	3.3	21.5	1.12	1.62	6.85
16OCT86	0000JT-8	13.5	5.92	11.30	8.0	88.1	2.4	3.3	21.5	1.20	1.64	6.92

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
30JUL86	.	.	0.030	0.1700	0.00300	0.230	0.00050	0.003	.	.	.	.
08AUG86	.	.	.	.	.	.	.	.	.	.	.	.
20AUG86	7.48	9.02	0.034	0.1400	0.00200	0.310	0.00050	0.003	0.0130	0.00015	0.0005	0.0010
04SEP86	.	.	0.014	0.1300	0.00100	0.230	0.00000	0.003	.	.	.	.
23SEP86	7.45	9.38	0.028	0.1050	0.00200	0.260	0.00050	0.004	0.0080	0.00015	0.0005	0.0010
16OCT86	7.44	8.90	0.026	0.1600	0.00550	0.210	0.00200	0.001	0.0120	0.00015	0.0005	0.0020

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
30JUL86	.	.	.	.	3.4	2.1	0.8	4.0	0.54	1
08AUG86	.	.	.	.	2.7	2.0	0.6	.	.	.
20AUG86	0.025	0.0010	0.0015	0.0110	1.4	0.6	0.8	.	.	.
04SEP86	.	.	.	.	3.3	2.4	0.8	.	.	.
23SEP86	0.047	0.0010	0.0015	0.0140	1.8	0.9	0.8	.	.	.
16OCT86	0.056	0.0010	0.0015	0.0190	1.6	1.1	0.4	.	.	.

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LAKE=TROUT:CITY OF NORTH BAY STATION=101

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
09JUN86	0000JC-2	12.9	5.98	11.70	8.5	88.0	2.6	3.1	21.5	1.16	1.61	6.47
15JUL86	000SH-1B	13.3	5.79	11.40	8.0	88.9	2.6	2.8	21.0	1.16	1.64	6.57
23SEP86	000JC-1B	12.7	6.01	11.00	8.0	85.9	2.4	2.7	22.0	1.13	1.65	6.43
16OCT86	000JT-1B	12.6	6.03	10.90	8.5	87.8	2.6	2.9	22.0	1.22	1.65	6.73

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
09JUN86	7.34	8.94	0.010	0.2750	0.00150	0.200	0.00000	0.006	.	.	.	.
15JUL86	7.13	9.79	0.016	0.2750	0.00550	0.220	0.00000	0.004	.	.	.	.
23SEP86	7.26	9.52	0.014	0.2750	0.00200	0.360	0.00000	0.008	.	.	.	.
16OCT86	7.04	8.00	0.016	0.3250	0.00200	1.620	0.00100	0.002	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
09JUN86	.	.	.	.	.	.	.	5.0	0.75	1
15JUL86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
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LAKE=TROUT:CITY OF NORTH BAY STATION=103

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
09JUN86	0000JC-5	12.3	5.87	11.60	8.5	86.5	2.6	3.9	21.5	1.16	1.62	6.39
15JUL86	000SH-3B	12.1	5.80	11.40	8.5	86.9	2.4	3.0	21.0	1.16	1.63	6.40
23SEP86	000JC-3B	12.6	5.82	10.80	7.5	85.5	2.6	2.7	21.0	1.11	1.61	6.39
16OCT86	000JT-3B	12.7	5.95	10.90	8.5	87.3	2.6	3.0	21.5	1.20	1.65	6.59

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
09JUN86	7.31	9.04	0.006	0.2700	0.00100	0.200	0.00000	0.002	.	.	.	.
15JUL86	7.08	9.74	0.018	0.2800	0.00600	0.220	0.00000	0.004	.	.	.	.
23SEP86	7.09	9.27	0.064	0.3000	0.00300	0.240	0.00000	0.004	.	.	.	.
16OCT86	7.08	8.30	0.010	0.3150	0.00250	0.530	0.00150	0.000	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
09JUN86	.	.	.	.	.	.	.	2.5	0.27	1
15JUL86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=104

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
10JUN86	0000SJ-5	12.4	5.55	11.10	7.0	84.4	2.4	3.8	20.0	1.14	1.58	6.15
15JUL86	000SH-4B	12.8	5.85	11.10	8.0	87.5	2.6	3.0	21.5	1.15	1.65	6.41
20AUG86	000JC-4B	12.8	6.10	10.70	8.5	85.5	2.6	3.1	22.0	1.17	1.63	6.56
23SEP86	000JC-4B	12.3	5.87	10.90	8.0	84.7	2.6	2.8	21.5	1.11	1.63	6.46
16OCT86	000JT-4B	12.4	5.87	11.00	8.5	86.2	2.2	2.9	21.5	1.18	1.64	6.52

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
10JUN86	7.14	3.16	0.010	0.2850	0.00200	0.200	0.00050	0.011	.	.	.	.
15JUL86	7.15	9.74	0.014	0.2700	0.00600	0.240	0.00000	0.005	.	.	.	.
20AUG86	7.42	9.18	0.004	0.3000	0.00100	0.230	0.00150	0.003	.	.	.	.
23SEP86	7.03	9.42	0.078	0.2850	0.00400	0.290	0.00000	0.003	.	.	.	.
16OCT86	7.23	8.00	0.062	0.3450	0.00650	9.550	0.00150	0.000	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
10JUN86	.	.	.	.	.	.	.	4.4	0.62	1
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=106

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
10JUN86	0000SJ-2	7.7	3.78	3.90	13.5	49.0	1.4	3.7	13.0	0.90	0.97	2.43
15JUL86	000SH-6B	8.2	3.94	3.45	15.0	50.6	1.6	3.7	14.0	0.90	0.99	2.53
20AUG86	000JC-6B	8.7	4.38	3.55	24.0	50.7	2.2	3.6	15.0	0.93	1.02	2.67
23SEP86	000JC-6B	8.6	3.98	3.45	15.0	49.9	1.4	3.1	14.0	0.84	0.98	2.46
16OCT86	000JT-6B	8.6	4.01	3.50	19.5	50.3	2.0	3.4	14.0	0.92	1.00	2.63

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
10JUN86	6.87	2.60	0.012	0.2450	0.00200	0.180	0.00050	0.007	.	.	.	.
15JUL86	6.76	7.81	0.036	0.2400	0.00450	0.260	0.00000	0.009	.	.	.	.
20AUG86	6.89	7.59	0.042	0.2750	0.00250	0.270	0.00100	0.013	.	.	.	.
23SEP86	7.22	7.86	0.008	0.2200	0.00100	0.190	0.00050	0.006	.	.	.	.
16OCT86	6.76	6.00	0.012	0.2900	0.00250	0.200	0.00200	0.005	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
10JUN86	.	.	.	.	.	.	.	8.0	1.48	1
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY   STATION=108

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)
10JUN86	0000SJ-7	11.8	5.84	11.60	8.0	80.4	2.6	3.4	21.0	1.18	1.62	6.30
15JUL86	000SH-88	14.3	5.52	11.50	9.0	91.3	3.2	3.0	20.5	1.24	1.67	6.50
20AUG86	000JC-88	14.4	6.44	11.60	8.5	90.6	3.0	2.9	23.0	1.27	1.73	6.80
23SEP86	000JC-88	16.1	6.95	11.30	10.5	93.2	4.2	2.9	25.0	1.29	1.86	6.69
16OCT86	000JT-88	13.1	5.99	11.40	8.0	87.2	2.2	3.4	21.5	1.68	1.65	7.20

SAMPLING DATE	PH	SSO4UR (MG/L)	NNHTFR (MG/L)	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)
10JUN86	7.37	2.97	0.018	0.2450	0.00250	0.200	0.00050	0.007	.	.	.	.
15JUL86	6.90	10.07	0.040	0.2750	0.00700	0.250	0.00000	0.008	.	.	.	.
20AUG86	7.30	9.36	0.080	0.2050	0.00200	0.400	0.00000	0.007	.	.	.	.
23SEP86	6.83	9.36	0.040	0.2950	0.00400	0.310	0.00000	0.008	.	.	.	.
16OCT86	7.41	7.10	0.024	0.1650	0.00800	0.340	0.00200	0.002	.	.	.	.

SAMPLING DATE	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)	CHLRAT (UG/L)	CHLRAC (UG/L)	CHLRBT (UG/L)	AVERAGE SUMMER P (MG/M3)	PREDICTED CHLORO A (MG/M3)	STATION TROPHIC STATUS
10JUN86	.	.	.	.	.	.	.	6.4	1.07	1
15JUL86	.	.	.	.	.	.	.	.	.	.
20AUG86	.	.	.	.	.	.	.	.	.	.
23SEP86	.	.	.	.	.	.	.	.	.	.
16OCT86	.	.	.	.	.	.	.	.	.	.

Appendix III

Chlorophyll *a* Concentration / Secchi Depth Relationship

Secchi depth measurements and chlorophyll a concentrations for Trout Lake, 1986.

	SECCHI DEPTH (m)						CHLOROPHYLL a CONCENTRATION (ug/L)					
DATE	1	3	4	6	8	$\overline{x}$	1	3	4	6	8	$\overline{x}$
May 13	5.25	5.25	6.5	4.75	-	5.4	1.0	1.1	1.0	1.4	-	1.1
May 27/29	5.0	5.25	5.0	4.75	5.0	5.0	0.6	0.6	0.6	1.0	0.7	0.7
June 9/10	5.0	4.5	4.0	4.0	5.25	4.6	1.4	1.4	1.6	1.7	1.4	1.5
June 25	5.5	5.25	5.0	3.75	4.5	4.8	2.3	2.6	2.8	2.3	2.4	2.5
July 8	5.5	4.75	6.5	4.75	5.0	5.3	1.7	1.2	1.5	1.5	1.7	1.5
July 15	4.0	5.0	5.75	5.5	5.0	5.1	1.4	1.4	1.3	1.5	1.3	1.4
July 30	2.0	3.75	5.0	3.25	4.0	3.6	2.3	2.9	2.5	2.5	3.4	2.7
Aug. 8	4.0	5.0	4.0	4.0	4.5	4.3	2.2	2.6	2.5	2.1	2.7	2.4
Aug. 20	5.0	5.0	5.5	5.0	3.5	4.8	2.4	3.1	1.9	1.9	1.4	2.1
Sept. 4	5.0	4.5	4.5	4.5	5.0	4.7	2.4	3.1	2.5	3.1	3.3	2.9
Sept. 23	6.5	5.5	6.25	6.5	6.25	6.2	0.2	-	2.0	1.9	1.8	1.5
Oct. 16	6.5	7.0	7.0	5.25	5.25	6.2	1.5	1.5	1.5	1.9	1.6	1.6
AVERAGE	4.9	5.1	5.4	4.7	4.8	5.0	1.5	1.9	1.8	1.9	1.9	1.8

\- Missing Data

Appendix IV

Theoretical Nutrient Modeling Calculations

and Explanation of Terms

PHOSPHORUS BUDGET CALCULATIONS

A prime concern of the Ministry of the Environment is to maintain acceptable water quality levels in lakes subjected to shoreline and backlot development pressures.

Water quality deteriorates with increasing quantities of algae because they decrease water clarity. Upon decay, algae deplete oxygen supplies needed to support fish populations.

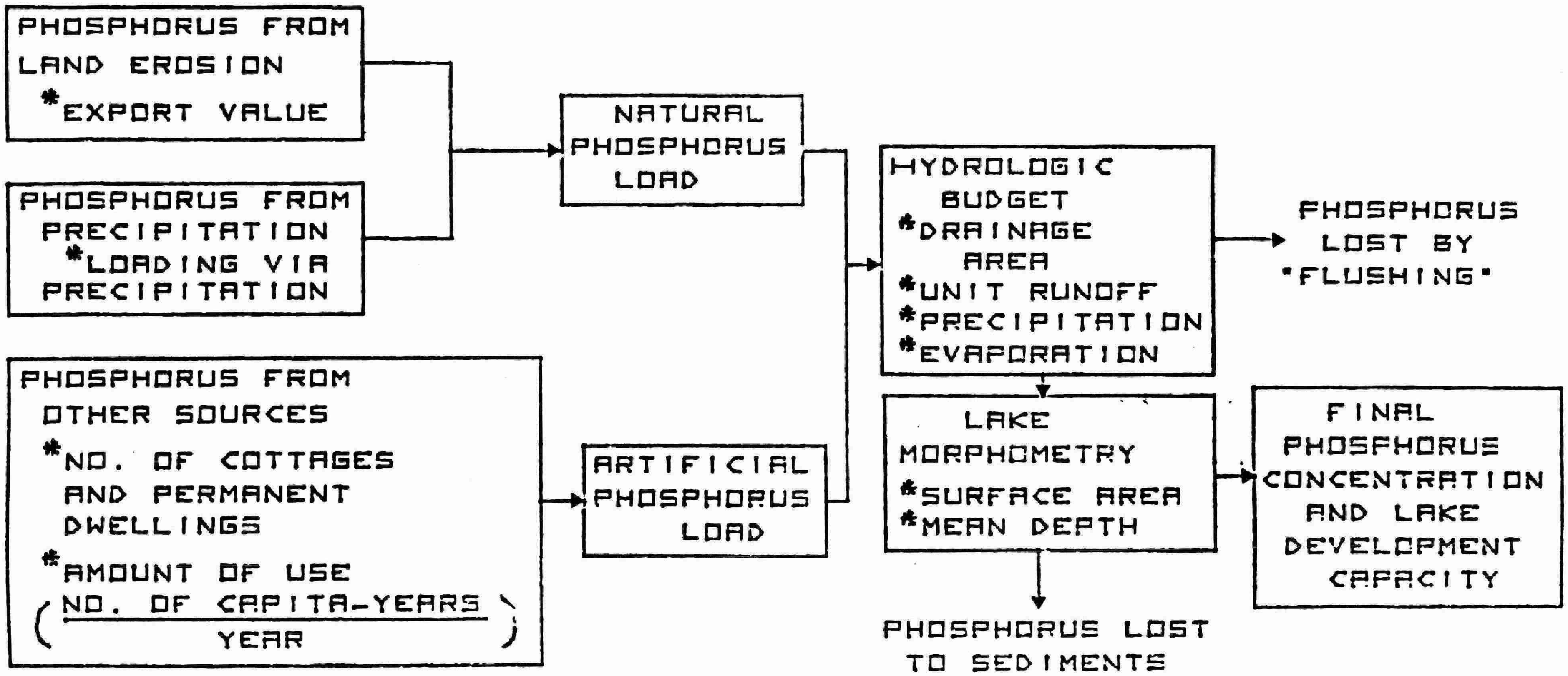
Phosphorus is the most important nutrient controlling the production of algae; so, the addition of phosphorus to a lake ultimately leads to a reduction of water quality.

Based on this concept, the average springtime phosphorus concentration can be used as an indication of the trophic status of a lake.

A mathematical model (Dillon, 1974) is used to provide a prediction of the average springtime phosphorus concentration in a lake by estimating natural and artificial inputs of phosphorus to the lake. The model is summarized in the accompanying flow diagram.

Natural inputs of phosphorus are due to the erosion and transport of phosphorus from the bedrock and surface soils, as well as dry fallout of dust containing phosphorus combined with phosphorus "washed" from the atmosphere via precipitation. Estimates of these inputs are shown in the key. The natural phosphorus supply (Jn) is determined using the following equations:

DILLON'S MODEL



* INDICATES AN INPUT PARAMETER

SUPPLY FROM LAND EXPORT $= \dfrac{E \times Ad}{10^6} = J_E$ (kg/yr)

SUPPLY VIA PRECIPITATION $= \dfrac{Lpr \times Ao}{10^6} =$ Jpr (kg/yr)

$$Jn = J_E + Jpr$$

Where E is the land export value from the key, Ad is the lake's drainage area, Ao is the lake's surface area, and Lpr is the loading via precipitation (22 mg/m^2/yr). An export factor of 4.4 mg/m^2/yr was used for Trout Lake and 3.9 mg/m^2/yr for Four Mile Bay, because of the igneous character of the bedrock geology and stream drainage densities of each watershed.

Artificial phosphorus inputs originate primarily from human wastes, although detergents and fertilizers may contribute some phosphorus also. In order to calculate the artificial phosphorus inputs some assumptions must be made. On the average each person excretes about 0.8 kg of phosphorus per year, all of which is assumed to eventually enter the lake. In Ontario, an average of 3.75 people per household per year and 0.77 people per cottage per year are assumed. The artificial phosphorus supply (Ja) from houses and cottages can then be calculated as:

$$Ja = (N_d \times 3.75 + N_c \times 0.77) \times 0.8 \text{ (kg/yr)}$$

Where N_d is the number of houses and N_c is the number of cottages.

The total phosphorus supply (Jt) is simply the sum of the artificial and natural phosphorus supplies:

$$Jt = Ja + Jn$$

However, much of the phosphorus supply to the lake goes directly into lake sediments or is transported farther downstream of the lake's outflow. Thus the hydrologic budget and retention capacity of a lake must be estimated before arriving at a final effective phosphorus concentration.

To determine a lake's hydrologic budget the total outflow volume (Q) must be found. It is calculated as the sum of the input of water to the lake from runoff (Ad.tur) and water input directly to the lake (Ao [Pr - Ev]).

$$Q = Ad.tur + Ao\,(Pr - Ev)$$

Where tur is the unit runoff in m/yr, Pr is the mean annual precipitation in m/yr and Ev is the mean annual evaporation in m/yr.

The lake's flushing rate (p) is found as:

$$p = \frac{Q}{V}$$

where V is the lake's volume in m^3.

The retention of phosphorus by the lake is determined by the retention coefficient which is highly correlated with the areal water loading (qs) where:

$$qs = Q/Ao$$

and the retention coefficient (Rp) is:

$$Rp = \frac{12.4}{12.4 + qs}$$

If there is an upstream lake on the watershed it will retain some of the phosphorus from its drainage area. For each upstream lake the retention coefficient of the upstream lake is used to reduce the phosphorus supply to the inflow of the next lake.

The final predicted average springtime phosphorus concentration in the lake is calculated from:

$$[P] = \frac{(1 - Rp) \times Jt \times 10^6}{0.956 \times qs}$$

To estimate the effect of any new development, the additional phosphorus supply is calculated and the new total phosphorus supply (Jt) is substituted back in the above equation to give another predicted springtime phosphorus concentration.

In the Northeastern Region, the new total phosphorus supply is calculated incrementally for two development types (permanent dwellings and seasonal cottages). Calculations are performed on an IBM microcomputer using a modified Lotus program showing development capacity for the existing level of water quality.

The basis of Dillon's model is the theoretical springtime phosphorus concentration which is obtained by estimating natural and artificial phosphorus supplies. Because of uncertainty regarding the agreement of theoretical spring phosphorus predictions with actual analytical determinations of spring phosphorus and the independence of the measured concentrations from possible "estimation" errors, the actual measured springtime phosphorus concentration of a lake is preferred as the basis for the determination of development capacity. Theoretical concentrations are computed for comparison.

KEY

SYMBOL	MEANING	UNITS
$\bar{Z}$	Mean depth of lake	m
Ao	Lake surface area	m^2
Ad**	Lake drainage area	m^2
Jn	Natural phosphorus supply	kg/yr
Ja	Artificial phosphorus supply	kg/yr
Jt	Total phosphorus supply	kg/yr
Nd	Number of houses	-
Nc	Number of cottages	-
Q	Total outflow volume	m^3/yr
tur	Total unit runoff	m/yr
Pr	Mean annual precipitation	m/yr
Ev	Mean annual evaporation	m/yr
P	Flushing rate	times/yr
qs	Areal water load	m/yr
Rp	Retention coefficient	-
Lpr	Phosphorus loading via precipitation	22 mg/m^2/yr
E*	Land export value derived from Table I	mg/m^2/yr

TABLE I: AVERAGE EXPORT VALUES (mg/m^2/yr)

GEOLOGICAL CLASSIFICATION

LAND USE		IGNEOUS	SEDIMENTARY
Forest	Range	0.7 - 8.8	6.7 - 18.3
	Mean	5.5	10.3
Forest & Pasture	Range	5.9 - 16.0	11.1 - 37.0
	Mean	9.8	19.8

NOTE: When E is in the 5.5 mg/m^2/yr category, the export value should be calculated as follows:

$$E = 1.32 + 5.54\ Dd$$

Where Dd is the "drainage density" and

$$Dd = \frac{(\text{Length of Each Input Stream})}{Ad} \qquad (km^{-1})$$

** Drainage area of a lake is found by planimetry of the watershed drawn on topographic maps.

Appendix V

Stream Water Chemistry Data

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=209

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-1	15.8	9.26	35.00	12.5	183.0	3.0	3.9	32.0	1.70	2.11	19.54	7.48	3.90	0.020
14JUL86	0000JC-1	19.6	10.70	44.20	22.5	216.0	4.0	4.6	36.5	1.74	2.40	25.30	7.64	11.25	0.030
21AUG86	0000JC-1	17.0	9.19	24.10	11.5	147.0	3.6	3.3	32.0	1.62	2.18	13.90	7.58	10.86	0.002
24SEP86	000JC-S1	16.2	9.07	24.90	10.5	149.0	3.4	3.5	31.5	1.58	2.17	13.90	7.47	11.31	0.022

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	1.3400	0.00500	0.330	0.00000	0.006	0.0450	0.00015	0.0010	0.0160	0.140	0.0010	0.0015	0.0180
14JUL86	0.8800	0.01400	0.360	0.00050	0.009	0.0960	0.00060	0.0010	0.0150	.	0.0010	0.0015	0.0170
21AUG86	0.8950	0.00100	0.250	0.00050	0.002	0.0330	0.00015	0.0005	0.0220	0.078	0.0010	0.0015	0.0200
24SEP86	0.9000	0.00250	0.270	0.00050	0.004	0.0280	0.00015	0.0005	0.0240	0.096	0.0010	0.0015	0.0250

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
-- LAKE=TROUT:CITY OF NORTH BAY STATION=210 --

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-2	14.4	6.91	2.35	11.5	78.9	2.4	2.7	24.0	1.27	1.60	2.51	7.45	6.54	0.006
14JUL86	0000JC-2	13.8	7.79	2.10	18.5	79.2	2.6	3.3	27.0	1.40	1.85	2.53	7.36	18.73	0.018
21AUG86	0000JC-2	19.6	9.17	1.60	11.0	94.3	4.2	2.3	32.5	1.74	2.36	3.05	7.58	21.20	0.002
24SEP86	000JC-S2	20.8	9.38	1.50	9.5	95.2	4.4	2.7	33.5	1.87	2.46	2.99	7.45	21.85	0.012

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.1150	0.00150	0.180	0.00000	0.003	0.2100	0.00400	0.0010	0.0060	0.130	0.0020	0.0015	1.4000
14JUL86	0.1150	0.00700	0.170	0.00050	0.002	0.2200	0.00400	0.0010	0.0070	.	0.0020	0.0015	1.5000
21AUG86	0.1800	0.00050	0.140	0.00050	0.001	0.2100	0.00300	0.0005	0.0070	0.160	0.0010	0.0015	1.7000
24SEP86	0.0800	0.00200	0.120	0.00050	0.002	0.1900	0.00300	0.0010	0.0060	0.130	0.0010	0.0015	1.5000

NORTHEASTERN REGION TECHNICAL SUPPORT
WATER QUALITY MONITORING PROGRAM 1986
LAKE=TROUT:CITY OF NORTH BAY STATION=211

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-3	10.6	5.01	8.95	37.0	73.3	2.0	5.0	18.0	1.16	1.26	5.30	7.14	2.88	0.020
14JUL86	0000JC-3	11.1	5.24	8.55	61.5	72.3	2.0	6.3	18.5	1.14	1.33	5.27	7.20	8.12	0.032
21AUG86	0000JC-3	16.4	7.32	12.10	42.0	97.2	3.4	4.3	26.0	1.56	1.87	7.18	7.44	9.44	0.014
24SEP86	000JC-S3	15.4	6.73	10.60	75.0	88.9	3.2	5.2	24.0	1.58	1.78	6.20	7.12	9.45	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.2250	0.00450	0.300	0.00050	0.015	0.1700	0.00030	0.0010	0.0020	0.450	0.0010	0.0015	0.0650
14JUL86	0.2150	0.01100	0.390	0.00200	0.020	0.2300	0.00015	0.0010	0.0020	.	0.0010	0.0015	0.0560
21AUG86	0.3500	0.00300	0.320	0.00100	0.015	0.1500	0.00015	0.0010	0.0010	0.620	0.0010	0.0015	0.0890
24SEP86	0.1800	0.00350	0.360	0.00050	0.019	0.1400	0.00200	0.0010	0.0020	0.610	0.0010	0.0015	0.0930

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-4	10.9	4.08	0.35	29.0	39.2	2.2	5.9	14.0	0.72	1.00	1.08	7.20	6.35	0.018
14JUL86	0000JC-4	13.4	4.66	0.70	59.5	42.9	2.4	7.4	16.5	0.87	1.17	1.24	7.28	5.03	0.048
21AUG86	0000JC-4	13.4	4.75	0.10	33.0	40.9	2.8	5.5	16.5	0.72	1.12	1.19	7.36	4.73	0.024
24SEP86	000JC-S4	15.4	5.13	0.35	27.5	47.2	3.2	4.8	18.5	0.96	1.33	1.30	7.35	6.12	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.0650	0.00400	0.300	0.00050	0.010	0.1500	0.00015	0.0010	0.0010	0.420	0.0020	0.0015	0.0050
14JUL86	0.1000	0.01100	0.470	0.00350	0.027	0.3100	0.00090	0.0010	0.0050	.	0.0020	0.0015	0.0090
21AUG86	0.0950	0.00200	0.370	0.00050	0.010	0.1200	0.00015	0.0010	0.0010	2.300	0.0010	0.0015	0.0000
24SEP86	0.0450	0.00150	0.290	0.00050	0.007	0.0920	0.00015	0.0005	0.0010	0.520	0.0010	0.0015	0.0000

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
10JUN86	0000SJ-9	15.7	4.72	0.70	43.0	183.0	2.6	8.2	17.0	0.66	1.24	1.27	7.46	2.01	0.006
14JUL86	0000JC-5	19.5	6.20	0.60	60.5	58.3	4.0	9.1	22.5	0.85	1.67	1.73	7.18	6.83	0.024
20AUG86	0000JC-5	22.5	7.10	0.20	60.0	58.3	4.6	9.2	25.0	0.97	1.80	1.97	7.41	5.25	0.020
24SEP86	000JC-S5	21.0	6.86	0.40	35.0	63.3	5.0	6.5	25.0	1.38	1.86	1.99	7.04	8.36	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
10JUN86	0.0050	0.00200	0.320	0.00050	0.009	0.1300	0.00015	0.0005	0.0010	0.330	0.0010	0.0015	0.0030
14JUL86	0.0250	0.00500	0.460	0.00250	0.021	0.2600	0.00015	0.0010	0.0010	.	0.0020	0.0015	0.0040
20AUG86	0.0100	0.00150	0.500	0.00050	0.017	0.1200	0.00015	0.0010	0.0010	1.100	0.0020	0.0015	0.0020
24SEP86	0.0450	0.00200	0.300	0.00000	0.008	0.0670	0.00015	0.0005	0.0000	0.450	0.0010	0.0015	0.0020

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-- LAKE=TROUT:CITY OF NORTH BAY STATION=214 --

SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
14JUL86	0000JC-6	12.7	5.55	14.70	70.5	92.7	2.2	7.9	20.0	1.39	1.44	8.66	7.17	6.34	0.038
21AUG86	0000JC-6	19.3	7.36	12.60	50.0	100.9	4.4	5.2	26.5	1.95	1.97	8.15	7.44	7.46	0.084
24SEP86	000JC-S6	18.5	7.07	12.40	39.0	98.9	4.0	5.1	25.5	2.03	1.92	7.76	7.22	7.75	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
14JUL86	0.1950	0.01150	0.460	0.00300	0.026	0.4200	0.00015	0.0010	0.0090	.	0.0050	0.0015	0.0180
21AUG86	0.3350	0.00350	0.540	0.00150	0.015	0.3500	0.00015	0.0010	0.0070	0.930	0.0050	0.0015	0.0120
24SEP86	0.1450	0.00300	0.280	0.00050	0.011	0.3000	0.00015	0.0010	0.0070	0.800	0.0050	0.0015	0.0140

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-7	11.5	3.56	0.40	102.5	34.7	2.2	12.3	14.0	0.34	1.22	1.09	6.99	2.24	0.052
14JUL86	0000JC-7	13.5	3.85	0.85	97.5	38.4	3.0	15.8	15.5	0.56	1.38	1.16	6.84	2.60	0.472
21AUG86	0000JC-7	20.0	6.08	0.40	120.0	51.0	5.4	12.6	22.5	0.57	1.82	1.24	6.87	3.27	0.076
24SEP86	000JC-S7	17.0	5.36	1.15	63.5	50.0	3.6	11.2	20.5	0.68	1.73	1.58	6.99	3.99	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.0600	0.00800	0.760	0.00350	0.033	0.1500	0.00015	0.0010	0.0010	0.600	0.0020	0.0015	0.0060
14JUL86	0.0300	0.00800	1.540	0.02450	0.123	0.1100	0.00100	0.0010	0.0030	.	0.0020	0.0015	0.0080
21AUG86	0.0100	0.00450	1.000	0.03150	0.120	0.0940	0.00015	0.0010	0.0010	2.700	0.0010	0.0015	0.0100
24SEP86	0.0450	0.00550	0.690	0.00400	0.031	0.1600	0.00015	0.0010	0.0010	0.730	0.0010	0.0015	0.0020

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-8	20.8	6.78	17.60	150.0	112.9	4.8	17.1	27.0	2.90	2.36	11.80	7.04	4.25	0.046
14JUL86	0000JC-8	21.6	8.18	38.00	92.5	186.0	4.2	14.1	32.0	0.75	2.83	22.80	7.31	6.75	0.076
21AUG86	0000JC-8	53.7	16.50	31.50	95.0	224.0	12.0	15.9	63.0	0.89	5.25	21.50	7.38	9.94	0.050
24SEP86	000JC-S8	29.4	10.30	38.10	94.5	196.0	6.6	16.1	39.5	1.40	3.37	.	7.18	6.26	0.000

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.0350	0.01050	0.940	0.02950	0.092	0.3100	0.00015	0.0010	0.0020	1.500	0.0020	0.0015	0.0100
14JUL86	0.0700	0.01300	0.910	0.01850	0.071	0.3000	0.00015	0.0010	0.0010	.	0.0020	0.0015	0.0060
21AUG86	0.0950	0.05600	1.480	0.02350	0.059	0.1700	0.00015	0.0010	0.0010	1.200	0.0010	0.0015	0.0090
24SEP86	0.0500	0.02550	0.830	0.01850	0.064	0.4000	0.00015	0.0010	0.0010	1.200	0.0020	0.0015	0.0060

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-9	25.8	9.21	41.60	107.5	197.0	6.2	15.2	37.0	0.98	3.42	22.20	7.02	3.70	0.112
14JUL86	0000JC09	34.2	10.50	33.20	102.5	184.0	7.4	15.2	43.0	0.97	4.08	18.50	7.35	3.28	0.128
21AUG86	0000JC-9	26.3	10.30	51.00	77.5	229.0	5.4	14.0	43.0	0.82	4.24	27.00	7.53	2.63	0.094
24SEP86	000JC-S9	35.1	11.30	39.30	75.0	208.0	8.2	13.4	46.5	1.93	4.43	20.20	7.10	4.83	0.078

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.0400	0.01150	1.000	0.01200	0.074	0.8000	0.00015	0.0030	0.0020	1.800	0.0030	0.0015	0.0060
14JUL86	0.0600	0.01750	1.070	0.01800	0.073	0.3500	0.00015	0.0010	0.0000	.	0.0020	0.0015	0.0030
21AUG86	0.0200	0.01100	0.940	0.00750	0.048	0.2500	0.00015	0.0010	0.0010	1.300	0.0020	0.0060	0.0030
24SEP86	0.0450	0.01300	0.990	0.01000	0.080	0.6300	0.00015	0.0030	0.0020	1.900	0.0030	0.0015	0.0050

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SAMPLING DATE	SAMPLE NUMBER	ALKT (MG/L)	CAUR (MG/L)	CLIDUR (MG/L)	COLTR (TCU)	COND25 (UMHO/CM)	DIC (MG/L)	DOC (MG/L)	HARDT (MG/L)	KKUR (MG/L)	MGUR (MG/L)	NAUR (MG/L)	PH	SSO4UR (MG/L)	NNHTFR (MG/L)
11JUN86	0000JS-5	19.8	8.66	30.00	18.0	162.0	4.4	5.0	31.0	1.67	2.22	18.10	7.32	9.47	0.040
14JUL86	000UC010	22.0	8.24	26.60	16.0	154.0	4.0	4.8	30.0	1.54	2.25	15.50	7.64	9.74	0.054
21AUG86	000JC-10	20.8	8.64	25.60	18.5	147.0	4.4	5.1	31.0	1.57	2.26	14.80	7.47	9.20	0.026
24SEP86	000JC-SO	30.2	11.60	47.20	21.0	231.0	6.8	7.7	41.0	2.13	3.00	.	7.25	9.01	0.044

SAMPLING DATE	NNOTFR (MG/L)	NNO2FR (MG/L)	NNTKUR (MG/L)	PPO4FR (MG/L)	PPUT (MG/L)	ALUT (MG/L)	CDUT (MG/L)	CRUT (MG/L)	CUUT (MG/L)	FEUT (MG/L)	NIUT (MG/L)	PBUT (MG/L)	ZNUT (MG/L)
11JUN86	0.1900	0.00750	0.510	0.00050	0.014	0.1100	0.00015	0.0005	0.0020	0.230	0.0010	0.0015	0.0080
14JUL86	0.1250	0.00850	0.380	0.00100	0.006	0.0320	0.00015	0.0005	0.0010	.	0.0020	0.0015	0.0080
21AUG86	0.0600	0.00100	0.350	0.00000	0.007	0.0290	0.00015	0.0005	0.0010	0.240	0.0010	0.0015	0.0030
24SEP86	0.0500	0.00150	0.480	0.00000	0.007	0.0240	0.00015	0.0005	0.0010	0.240	0.0010	0.0015	0.0030